Compressed Air Magazine

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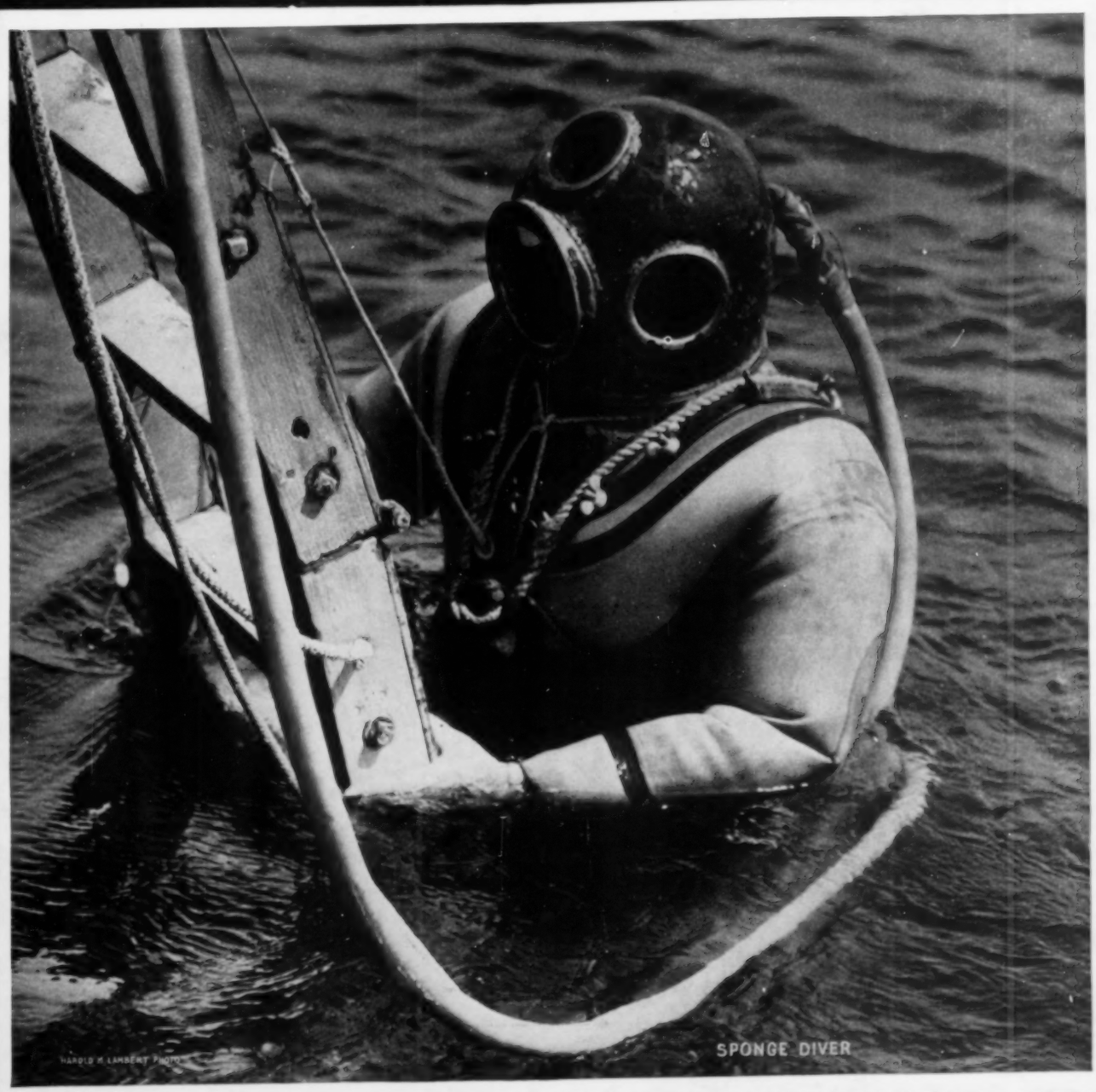


SPONGE DIVER

"THEY THOUGHT I WAS FRESH-AIR CRAZY... BUT EVERY ONE OF THOSE COPPUS BLOWERS HAS PAID FOR ITSELF OVER AND OVER AGAIN..."

— *says this* Plant Superintendent, after a year's test of Coppus Blowers

ANOTHER CASE
WHERE COPPUS BLUE RIBBON PRODUCTS MAKE GOOD ON THE JOB

"Frankly, I was considered a crank about getting ventilating equipment for our plant . . . now, after a year's experience with Coppus Blowers, everyone here recognizes the increased efficiency of both men and machines. Specific results were lower sickness costs and higher working efficiency with fewer halts in production. A dozen Coppus Blowers in various places have been operating continuously for a year without repairs or trouble of any kind."

In reducing temperatures (often as much as 35°) around furnaces and motors, and in making dangerous confined spaces fit for labor, Coppus air-handling equipment has cured many cases of halting production and poor morale.

Whatever your requirement, Coppus has the right piece of equipment — not a "catch-all" for general use — *engineered especially for you*. The Blue Ribbon on a Coppus Blower, Exhauster, or Heat Killer means the same precision workmanship and careful inspection that are responsible for winning high honors in many industries today.

COPPUS

Coppus Engineering Corporation, 223 Park Avenue, Worcester, Massachusetts
Sales Offices in THOMAS' REGISTER. Other Blue Ribbon Products in SWEET'S CATALOG: air filters, gas burners, steam turbines, etc.

THESE COPPUS BLUE RIBBON PRODUCTS
Are
Designed for Your Industry, Engineered for You

Just check on this coupon the equipment likely to fit your requirements. Mention your industry, and we will send you, without obligation, complete facts.

PLEASE SEND ME INFORMATION ON

Supplying Fresh Air to Men Working:

- ☐ in tanks, tank cars, drums, etc.
- ☐ in underground cable manholes.
- ☐ on coke ovens.
- ☐ on steam-heated rubber processes.
- ☐ around cracking stills.
- ☐ on boiler repair jobs.

COOLING:

- ☐ motors, generators, switchboards.
- ☐ wires and sheets.
- ☐ general man cooling.
- ☐ supplying fresh air to storage tanks on tank farms.
- ☐ exhausting welding fumes.
- ☐ stirring up stagnant air wherever men are working or material is drying.
- ☐ drying of walls, sheets etc., after treated with coating material.

NAME .....
COMPANY .....
ADDRESS .....
CITY .....

(Write below any special ventilating problem you may have.)

You can almost SEE this tunnel move

. . . 55 feet per day

"LONG JOHN" AUSTIN, 6-foot 8-inch ace tunnel superintendent, is breaking record after record driving the 32,000-foot Carlton tunnel which will drain the famous Cripple Creek gold mining district in Colorado.

There's an interesting story behind this job:

The first two miles were excavated in 121 and 108 days respectively—using one type of hollow drill steel.

At the start of the third mile, Mr. Austin switched to Bethlehem Superior Hollow Drill Steel. In only 96 days the mile was complete. Still using Bethlehem Superior, Mr. Austin polished off the next two miles in 95 and 94 days respectively.

His average was better than 55 feet per day through tough Pikes Peak granite. Mr. Austin says he does not see how drill steel could perform any better, since on the last three miles he has encountered harder rock, and has moved his drills much further from the compressors.

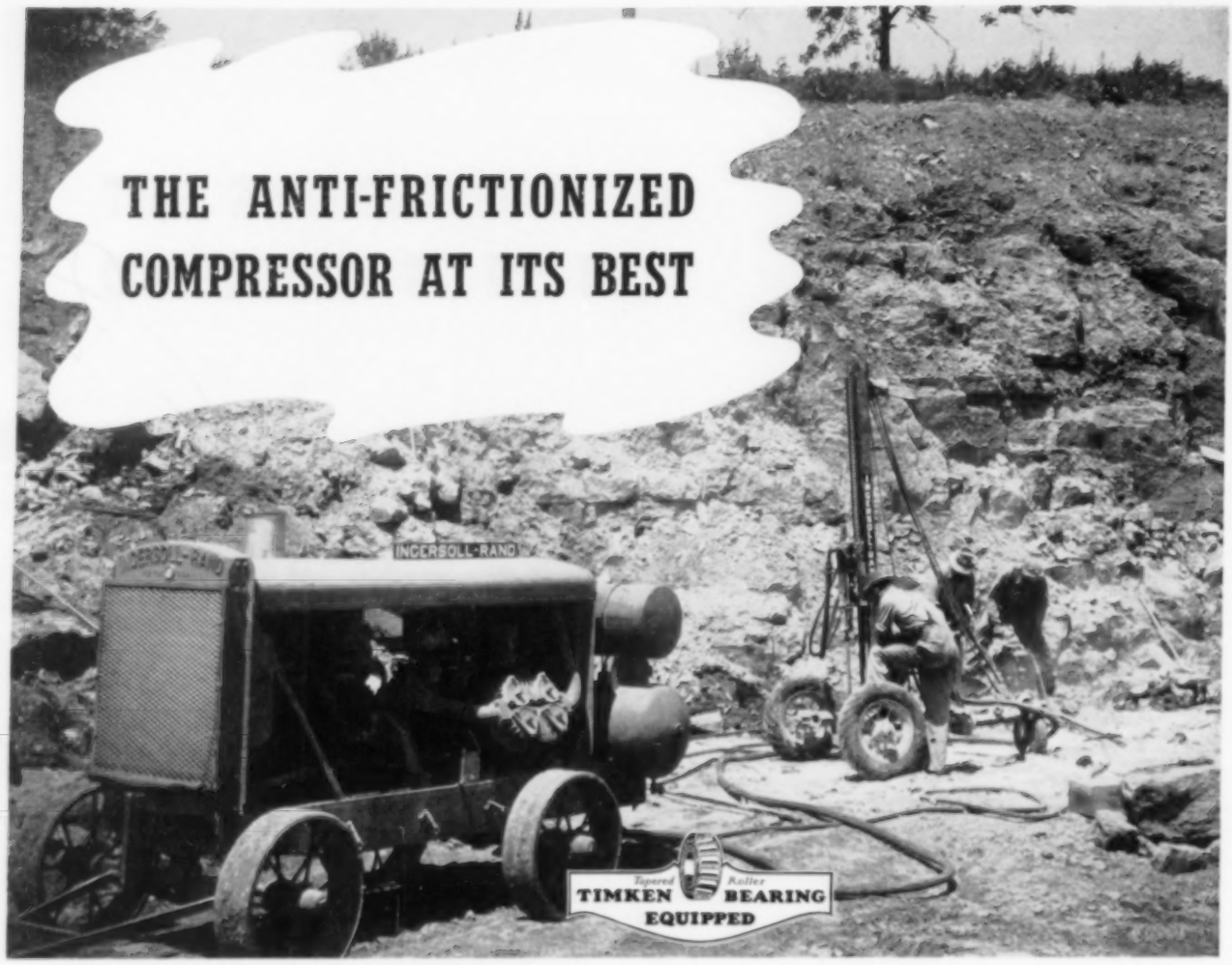
We feel that Mr. Austin's experience with Bethlehem Superior is about as strong evidence of the quality of the product as could be desired. We suggest you try this steel on your next job. Bethlehem Superior has a smooth well-centered hole. It is easy to heat treat. It delivers the goods.

Bethlehem Superior
HOLLOW
Drill Steel

BETHLEHEM STEEL

BETHLEHEM STEEL COMPANY

THE ANTI-FRICTIONIZED COMPRESSOR AT ITS BEST



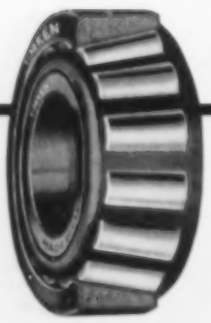
Ingersoll-Rand Model 315 Two-stage Air-cooled Portable Compressor equipped with TIMKEN Bearings on the crank shaft.

If you are thinking of buying an anti-frictionized compressor, get one that will give you anti-friction advantages in full—Timken Bearing Equipped.

TIMKEN Bearings are the ideal anti-friction bearings for compressors of all types because, besides eliminating friction, they hold the crank shaft in correct and constant alignment and carry radial, thrust and combined loads.

Furthermore, being made of TIMKEN Electric Furnace Alloy Steel these bearings are supreme in strength and endurance; that means dependability, long life and low upkeep cost.

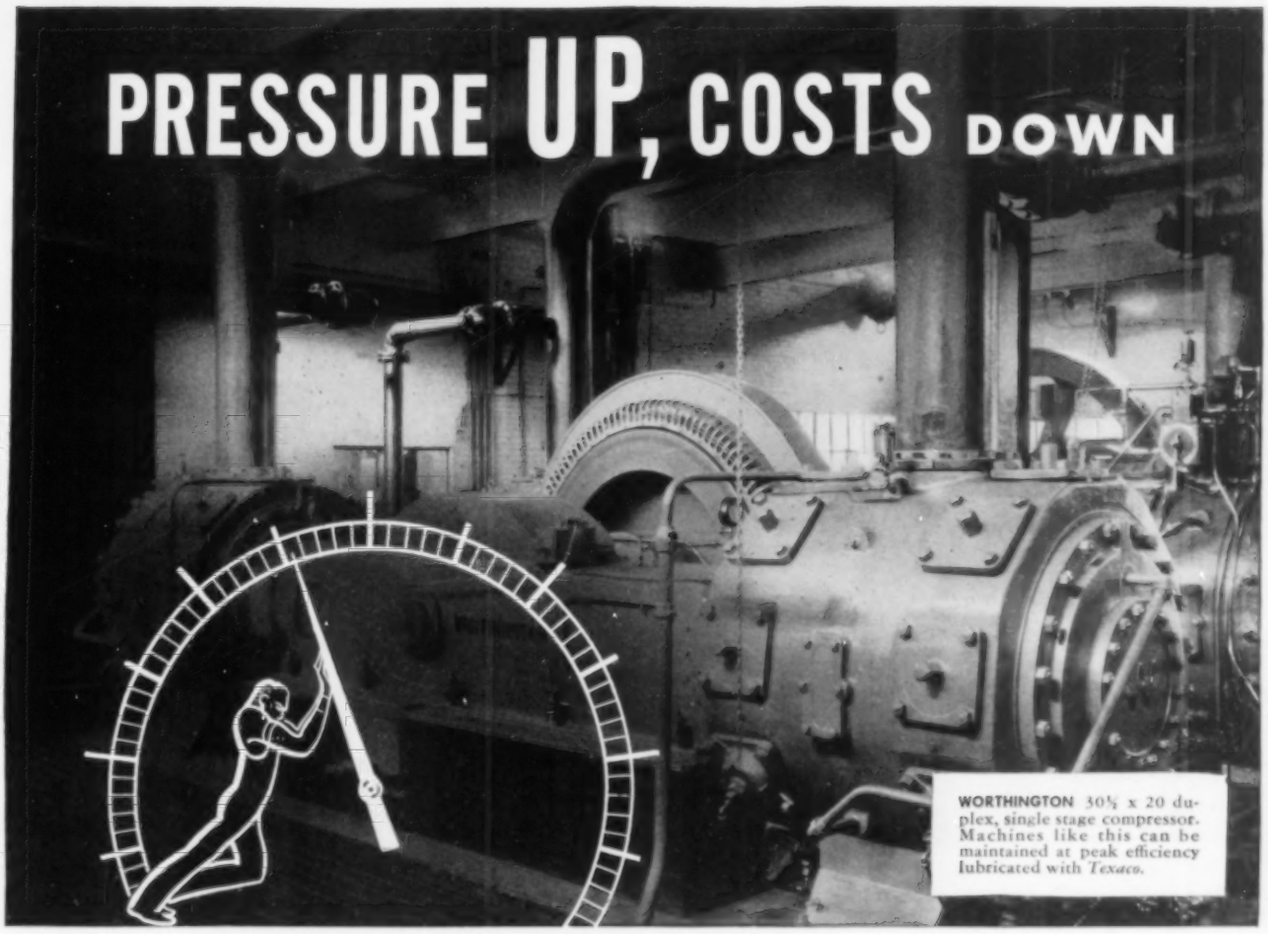
THE TIMKEN ROLLER BEARING COMPANY, CANTON, OHIO



Manufacturers of TIMKEN Tapered Roller Bearings for automobiles, motor trucks, railroad cars and locomotives and all kinds of industrial machinery; TIMKEN Alloy Steels and Carbon and Alloy Seamless Tubing; and TIMKEN Rock Bits.

TIMKEN
TAPERED ROLLER BEARINGS

PRESSURE UP, COSTS DOWN



WORTHINGTON 30½ x 20 duplex, single stage compressor. Machines like this can be maintained at peak efficiency lubricated with *Texaco*.

DO YOU WISH your gauge pointer would stay put? To *keep* air pressure up, you must keep your compressor valves CLEAN . . . opening wide and shutting tight.

Thousands of operators are using *Texaco Alcaid, Algol or Ursa Oils* to get these results, maintaining compressors at peak efficiency, assuring operating economy.

These oils are highly stable, resist gumming, sludging and the formation of carbon deposits.

The outstanding performance that has made Texaco preferred in each of the fields listed in the panel has made it preferred by some of the largest compressor operators in the world.

These Texaco users enjoy benefits that can also be yours. A Texaco Lubrication Engineer will gladly cooperate. Phone the nearest of more than 2300 distributing plants in the 48 States, or write:

The Texas Company, 135 East 42nd Street, New York, N. Y.

Texaco Dealers invite you to enjoy **FRED ALLEN** in a full-hour program every Wednesday night, CBS, 9:00 E.D.T., 8:00 E.S.T.; 8:00 C.D.T., 7:00 C.S.T.; 9:00 M.S.T.; 8:00 P.S.T.

ROCK DRILLS—a 36-page booklet of pictures and text to help you keep your rock drills on the job. Yours for the asking.

THEY PREFER TEXACO

★ More stationary Diesel horsepower in the U. S. is lubricated with Texaco than with any other brand.

★ More Diesel horsepower on streamlined trains in the U. S. is lubricated with Texaco than with all other brands combined.

★ More locomotives and cars in the U. S. are lubricated with Texaco than with any other brand.

★ More tourists use Texaco *Fire-Chief* Gasoline than any other brand.

★ More revenue airline miles within the U. S. are flown with Texaco than with any other brand.

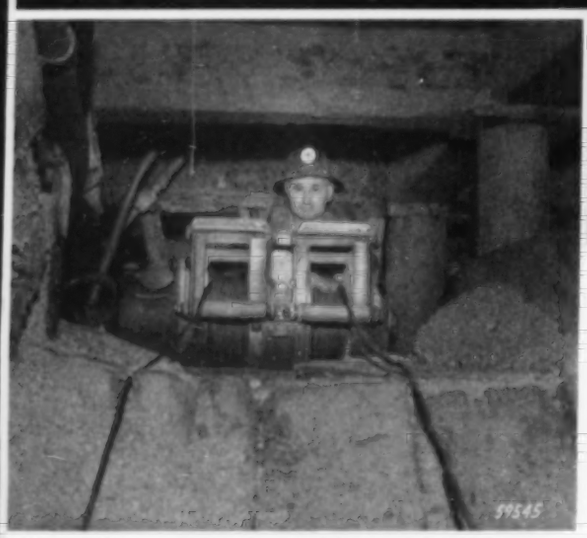
★ More buses, more bus lines and more bus-miles are lubricated with Texaco than with any other brand.

TEXACO REG. T.M.

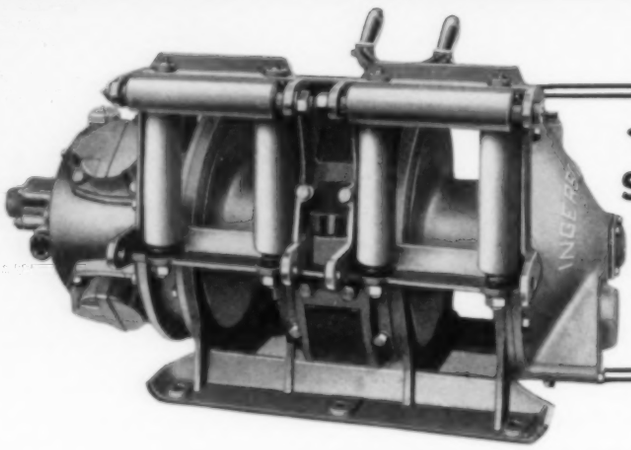
TEXACO Lubricants
FOR ALL COMPRESSORS AND AIR TOOLS

Double Purpose SCRAPER HOIST

A MONEY-SAVER FOR EITHER DEVELOPMENT OR STOPING WORK



ABOVE—The Size HNN-1J Double-Drum Air Hoist, mounted on a wooden ramp, and used with scraper to drive short flat winzes, flat inclines, intermediate drifts, or sections where vertical raises are started. BELOW—The same hoist operating an open-hoe scraper in a stope.



The 730 LB. SIZE HNN-1J DOUBLE-DRUM AIR HOIST

This handy hoist can be used for all-around heading work . . . whether on a mine level or in driving an intermediate. And when drifting work is completed, it can be kept in continuous service on practically every known system of stoping and filling.

This "double-purpose" scraper hoist has paid big dividends to an Idaho lead-zinc property whose orebody does not permit a systematic mining method because of the great variations in the dip and the extreme faulty conditions. Mining operations are carried out wherever ore is available. Because of its light weight and reliability this air-operated unit is perfectly suited for this type of work.

This and other I-R hoists are saving money for mines everywhere. There are over 450 sizes and types from which to choose.

Ingersoll-Rand

11 BROADWAY, NEW YORK CITY

8-32

Branches or Distributors in other Principal cities the world over.

Atlanta	Butte	Dallas	El Paso	Knoxville	New York	Pottsville	Seattle
Birmingham	Chicago	Denver	Hartford	Los Angeles	Philadelphia	Salt Lake City	St. Louis
Boston	Cincinnati	Detroit	Houston	Newark	Picher	San Francisco	St. Paul
Buffalo	Cleveland	Duluth	Kansas City	New Orleans	Pittsburgh	Scranton	Tulsa
							Washington

Montreal Mexico Havana Rio de Janeiro Caracas Buenos Aires Lima London Paris Madrid Lisbon Melbourne Calcutta Johannesburg

SIMPLIFY YOUR MINING SYSTEM WITH I-R SCRAPER HOISTS

The EIMCO WAY is the BEST WAY

The world-wide success of the Eimco-Finlay Loader has, naturally, brought other mucking machines into the field—all of which resemble it as closely as possible, both in appearance and in general operating principle. When contemplating the purchase of a mucking machine, however, the following important considerations should be kept in mind:

FIRST Eimco patents give exclusive rights to the use of any rocker-arm profile other than a segment of a true circle, and to the use of any rocker-arm which rolls on a supporting track or bed. No other known method for controlling the action of a mucking machine permits such simple sturdy construction or gives such high operating efficiency.

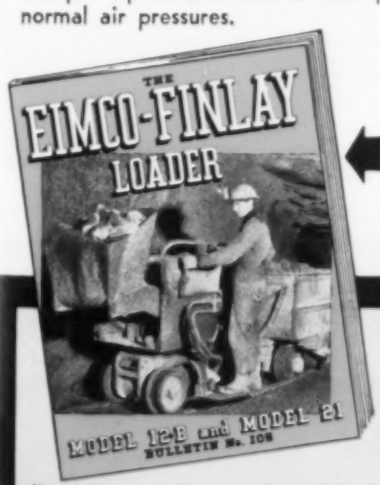
SECOND The Eimco method of rolling the rocker-arm-and-bucket assembly on a supporting bed or track, eliminates all necessity for unenclosed racks and pinions, as well as for rollers, slides, etc., in the side-sheets—all of which, in other mucking machines, are exposed to mud and muck. The weight of the Eimco rolling assembly is supported by a massive steel casting—instead of being hung from relatively weak side-sheets.

THIRD Eimco's positive, yet flexible, method of holding the rocker-arm and bucket assembly in position with powerful steel-wire cables permits the rocker arms to roll over small pieces of rock or other obstructions on the supporting tracks without damage, and without interrupting the loading cycle.

FOURTH The patented Eimco-Finlay Rocker-Arm mucking action eliminates all necessity for auxiliary air cylinders, cut-off and kick-back devices or other trouble-making "gadgets" of any kind. The only reason for having these "gadgets" on subsequently developed mucking machines is to achieve a comparable operating cycle without violating our patent rights.

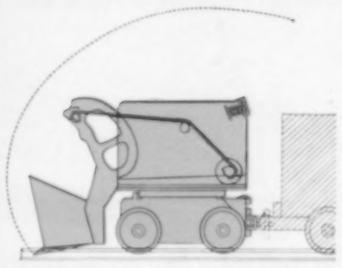
FIFTH Because the Eimco-Finlay Loader has no "gadgets" both air consumption and maintenance expense are very much lower than for any other type of mucking machine.

SIXTH High-Torque, High-Power FIVE-CYLINDER Ingersoll-Rand motors are now standard equipment on all Eimco-Finlay Loaders. The wide margin of reserve power thus provided permits efficient operation on air pressures as low as 40 lbs. per sq. in. and assures incomparably brilliant performance on normal air pressures.



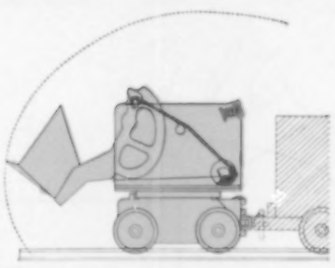
Bulletin 105 (36 large fully-illustrated pages) gives complete information regarding the design, construction and operation of Eimco-Finlay Loaders. Really a text book on mechanical mucking. Write for free copy and tell us about your loading requirements.

NO OTHER MUCKING MACHINE HAS THESE MONEY-SAVING ADVANTAGES



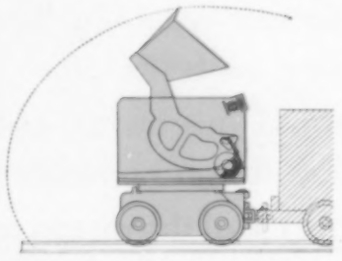
MAXIMUM FORCE WHEN NEEDED

Tremendous force is secured throughout the digging portion of stroke by patented profile of rocker arm, small diameter of winding reel, and long leverage through which chain-pull is applied. One reason why Eimco-Finlay Loaders use less air.



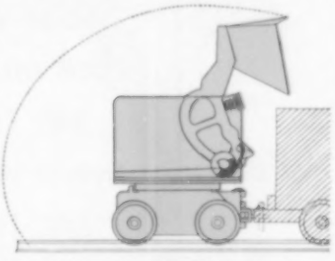
MAXIMUM FORWARD THRUST

Patented Rocker-Arm Profile permits bucket to move forward as well as upward while digging into muck pile, thereby reducing the amount of "crowding" required to fill the bucket, and cutting down air consumption.



REQUIRES LESS HEAD-ROOM

Patented Rocker-Arm Profile flattens arc of bucket so that highest point is very little higher than that of bucket in dumping position. The reduced head-room requirements often permit important savings. At this stage of stroke, reversed leverage and rapidly increasing diameter of chain reel, combine to accelerate speed of bucket travel, thereby giving ample momentum for throwing load back into car.



AUTOMATIC PROTECTION against DUMPING SHOCKS . . . . . BUCKET RETURNS BY GRAVITY

When bucket reaches dumping position chain-pull is on dead center, thereby automatically protecting motor and gear-train against dumping shocks wtihout need for air-cut-off device. Bucket returns by gravity (under control of operator) thereby eliminating any need for "kick-back" device.

. . . . . and don't overlook EIMCO'S SUPERIOR AUTOMATIC CENTERING MECHANISM

If the Eimco-Finlay Loader had no other superior features its patented automatic centering device—for lining up the bucket and rocker-arm assembly with the wheel-base and attached car when digging from a side position—would entitle it to preference. This simple cam-type mechanism operates so smoothly and dependably that no thought or effort whatever is required from the operator. No other type mucking-machine centering device gives such satisfactory service or costs so little to maintain.

A convenient adjustment permits manual direction of bucket discharge in the rare cases when operation on a sharp curve necessitates off-center dumping to prevent spillage.

Our Guarantee

Year after year, far more Eimco-Finlay Loaders are manufactured and sold than all competitive types combined, and their inherent superiority has been so thoroughly proved that every machine sold now carries a positive money-back guarantee that it will outlast and out-perform any other mucking machine of comparable size and type at any air pressure, and under any working condition.

THE EIMCO CORPORATION
SALT LAKE CITY, UTAH, U.S.A.

NEW YORK, 120 Broadway
EL PASO, Mills Bldg.
CHICAGO, 111 W. Washington St.
SACRAMENTO, 1217 7th St.

INGERSOLL-RAND CO., LTD.
165 Queen Victoria St., London, Eng.
* BRITISH MIN. SUP. CO. (PTY.), LTD.
Troye House, Johannesburg, S. A.
* HODGSON & CRANSTON
Boulder Road, Kalgoorlie, Australia
CLYDE ENGINEERING LTD.
Wellington, New Zealand
* MINE EQUIPMENT COMPANY LTD.
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* B. C. EQUIPMENT CO., LTD.
551 Howe St., Vancouver, B. C.
* MARSMAN TRADING CORPORATION.
Manila and Baguio. Philippine Is.
INTERNATIONAL MACHINERY CO.
Rio de Janeiro, Santiago and Antofagasta

** Replacement parts carried in stock by agents indicated by asterisks*

Air Drills Pull

WITH GARGOYLE VOCO

TO KEEP AIR DRILLS punching hard, you need correct lubrication. Your oil must do all these jobs:

☛ It must stick tight . . . even under constant washing by moisture entering with the air.

☛ It must minimize cylinder wear with a tough lubricating film.

☛ It must seal the piston against power-wasting "blow-by" to help keep air costs down.

☛ It must function under low temperatures, prevent valve sticking, and maintain full drill speed.

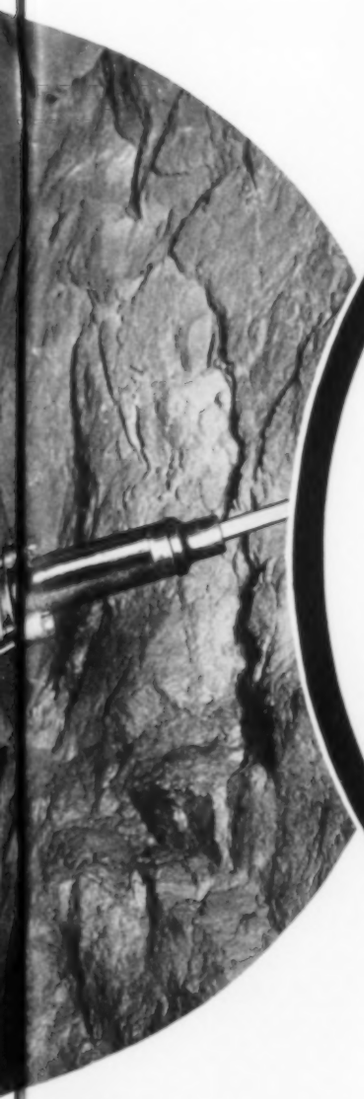
Gargoyle Voco Engine Oil No. 1 is the oil that meets all these "musts." This famous oil helps keep your air drills hammering home profits.

CALL IN Socony-Vacuum for

YOU'LL BENEFIT FROM: 75 YEARS' LUBRICATION EXPERIENCE • PRODUCTS APPROVED BY ENGINE BUILDERS •

No Punches

ENGINE OIL NUMBER 1



GARGOYLE

Lubricants

The Emblem of
75 YEARS' PIONEERING
in "Correct Lubrication"
1866-1941

"Correct Lubrication"

THE RIGHT OIL FOR EACH JOB • NEW LUBRICANTS AHEAD OF NEW NEEDS •

SOCONY-VACUUM OIL COMPANY, INC. • Standard Oil of New York Div. White Star Div. • Lubrite Div. • Chicago Div. • White Eagle Div. • Wadhams Div. • Magnolia Petroleum Co. • General Petroleum Corp. of Calif.

THE FLEX-DISC CLUTCH

Positive connection between flywheel and drive disc through resilient links, eliminating any possibility of looseness or wear at this point.

Spring loaded, non-adjustable driven disc keyed solidly to the compressor shaft preventing looseness or wear between clutch and shaft.

Drive plate quickly detachable in segments for relining worn facings without disturbing any other part of engine-compressor assembly.

No dragging between driven and driving discs when clutch is disengaged and no running contact between throw-out collar and clutch when compressor is operating.

This is the *Flex-Disc* Clutch, (13½" double), used in the largest of the new Ingersoll-Rand *Mobil-Air* Portable Compressors, the 500 cfm. Like the smaller *Flex-Disc* clutches used in the lower capacities, it was designed especially for doing its bit toward fine performance and low maintenance for *Mobil-Air*.

INDUSTRIAL CLUTCH COMPANY

Waukesha Wisconsin

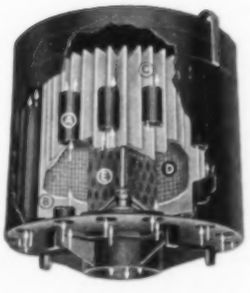
STAYNEW FILTERS

What Does the Name "STAYNEW" Mean? » » » » » » »

1. Less Wear on Engines and Compressors
2. More Service from Air-Powered Tools
3. Longer Lasting Filters

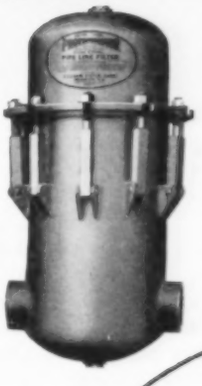
ENGINE AND EQUIPMENT-SAVING FILTERS FOR INDUSTRY

FOR ENGINE PROTECTION



Models D, DS: Permit only clean, dust-free air to be drawn into engine and compressor intake. Model DS features rectifying tubes of scientific diameter to length ratio that "quiets the thump that hurts your ears." Feltex Filtering Medium in Radial Fin Construction provides greatest possible filtering area and efficiency with permanently low restriction to air flow. D and DS Protectomotors make new engines and compressors stay new—add to life and efficiency of old ones.

FOR LIQUID LINES (Including Water)



Models CPHL, CPHLS: Famous Radial Fin Construction applied to the filtration of liquids. Fuel and lubricating oil models remove abrasive matter from all lines for engines and compressors, preventing excessive wear of all parts lubricated by crankcase oil system; prevent, also, clogging and wear of fuel nozzles. All parts stay new longer. Swing-bolted head if required.

NEW WATER FILTER: An outstanding success everywhere. Used in scores of applications where pure filtered water is a necessity.

FOR COMPRESSED AIR & GAS LINES

Models CP, CPH: Hundreds of thousands in use throughout industry. Guaranteed delivery of clean, dry air, free from dust, dirt, pipe-scale, rust, water. All air-powered tools operate more efficiently, last longer when air supply is kept clean with Protectomotor Pipe Line Filters. Protectomotors often save their cost in a few months. Like all Staynew and Protectomotor filters—easy to inspect, easy to clean, low restriction to air flow, long lasting. Models for horizontal and vertical installation.

Get the Entire Story!

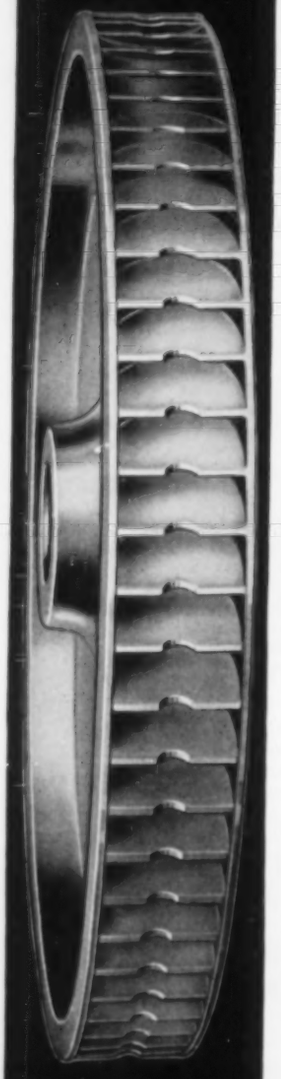
Find out about Staynew and Protectomotor engine and equipment-saving features: Radial Fin Construction—Feltex and Glastex Filtering Mediums—*Double* Counter-clockwise Rotating Curtains—Fire-resistant Wire Kladding, etc., etc. *Catalog describes entire line, including filters for building ventilation.*

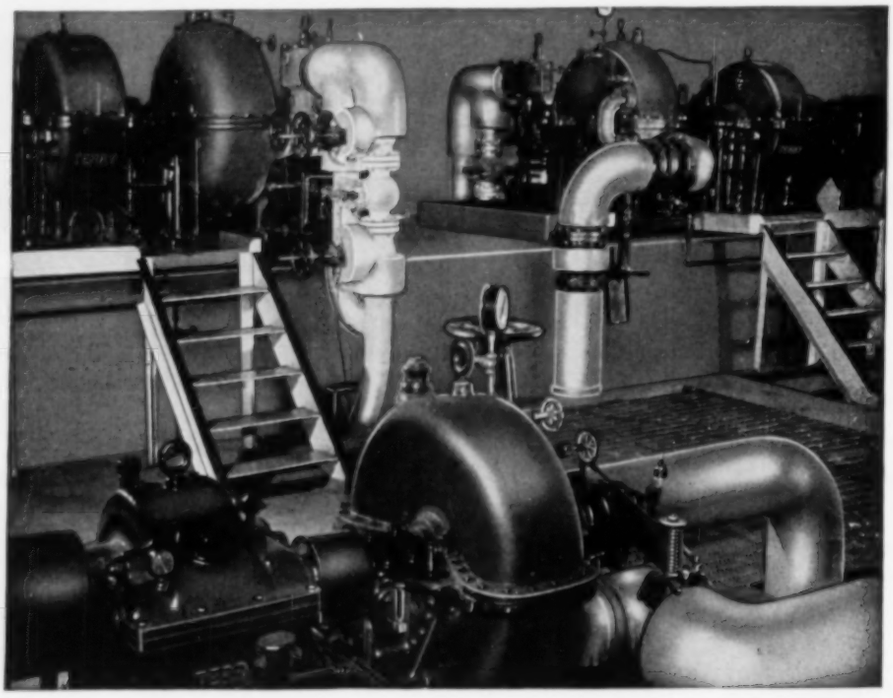
WRITE FOR COMPLETE CATALOG

PROTECTOMOTOR 99 44/100 Per Cent AIR FILTERS

STAYNEW FILTER CORP.
7 Leighton Ave., Rochester, N. Y. *"Filter Headquarters"*

TERRY





TERRY SOLID WHEEL TURBINES AGAIN SELECTED BY A LEADING STEEL COMPANY

Shown above are three Terry Turbo-Gear Units installed in a boiler house of one of the country's leading steel producers. These units (plus a fourth not shown) drive draft fans and were placed in service in 1936.

Recently, this company expanded this boiler plant and based upon the superior service that these units have given during the past four years again selected Terry's.

The units all employ the Terry solid wheel which has generous rotor clearances and double rim protected blading. The buckets are milled out of solid metal so that there are no parts to work loose. The entire construction is unusually durable, simple, and fool-proof.

The Terry wheel turbine is fully described in our bulletin S-116. A request on your business letterhead will bring a copy.

Above;
Two 700 HP and one 270 HP Terry Turbines driving draft fans through Terry reduction gears.

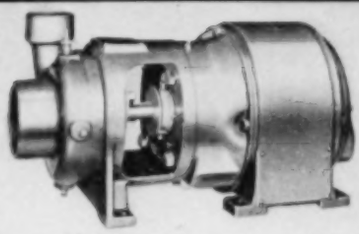
T-1137

THE TERRY STEAM TURBINE COMPANY
TERRY SQUARE, HARTFORD, CONN.

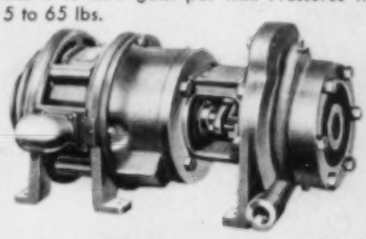
THE PUMP YOU NEED—

When You Need It...

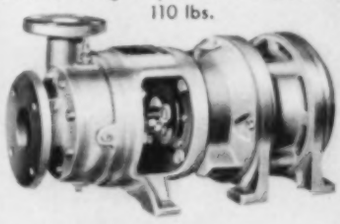
Motorpumps



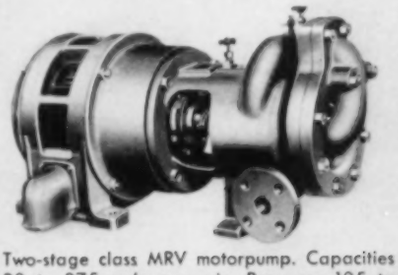
Single-stage class RVN motorpump. Capacities 5 to 250 gals. per min. Pressures from 5 to 65 lbs.



Two-stage class RVN motorpump. Capacities from 5 to 50 gals. per min. Pressures 60 to 110 lbs.



Single-stage class RV motorpump. Capacities 10 to 1500 gals. per min. Pressures 5 to 105 lbs.

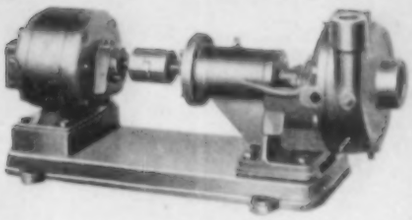


Two-stage class MRV motorpump. Capacities 20 to 275 gals. per min. Pressures 105 to 215 lbs.

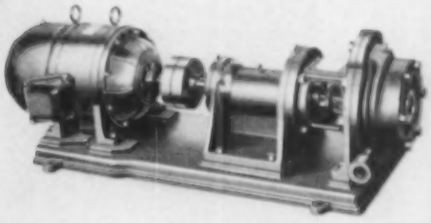
When you want a pump in a hurry, Ingersoll-Rand can, in many cases, ship it to you from stock. Pumps shown on this page are available in capacities from 5 to 1500 gals. per min. for pressures from 5 to 215 lbs. per sq. in. Furthermore, they are quality pumps that you can depend on to give many years of trouble-free service. They are available with both open and closed impellers for handling almost any type of liquid. Let our engineers tell you more about them.

In addition to the pumps illustrated there are other I-R pumps for practically every pumping requirement.

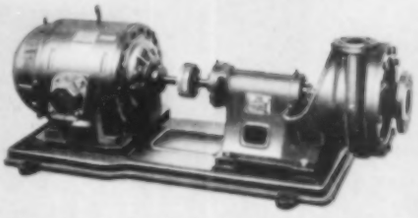
CRV Pumps Any Type of Driver



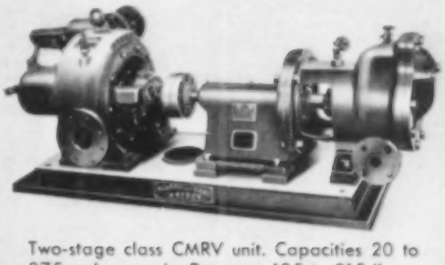
Single-stage class CRVN unit. Capacities 5 to 250 gals. per min. Pressures 5 to 65 lbs.



Two-stage class CRVN unit. Capacities 5 to 50 gals per min. Pressures 60 to 110 lbs.

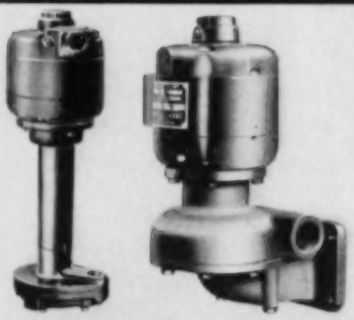


Single-stage class CRV unit. Capacities 5 to 1500 gals. per min. Pressures 5 to 105 lbs.



Two-stage class CMRV unit. Capacities 20 to 275 gals per min. Pressures 105 to 215 lbs.

KRV Pumps For Handling Coolant and For Air Conditioning Units.

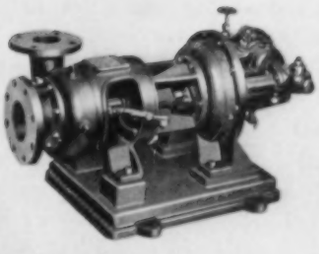


¾ and 1 KRV pump. Capacities 3 to 30 gals. per min. Heads to 15 ft.

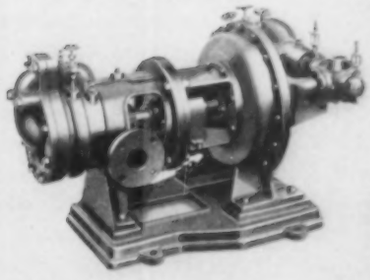
1¼ KRV pump. Capacities 5 to 50 gals. per min. Heads to 25 ft.

TRV Pumps For General Service—Steam Turbine Drive

Class TRVNL unit. Capacities 5 to 60 gals. per min. Pressures 5 to 65 lbs.



Single-stage class TRV unit. Capacities 5 to 1500 gals. per min. Pressures 5 to 105 lbs.



Single-stage class TMRV unit. Capacities 20 to 275 gals. per min. Pressures 105 to 215 lbs.

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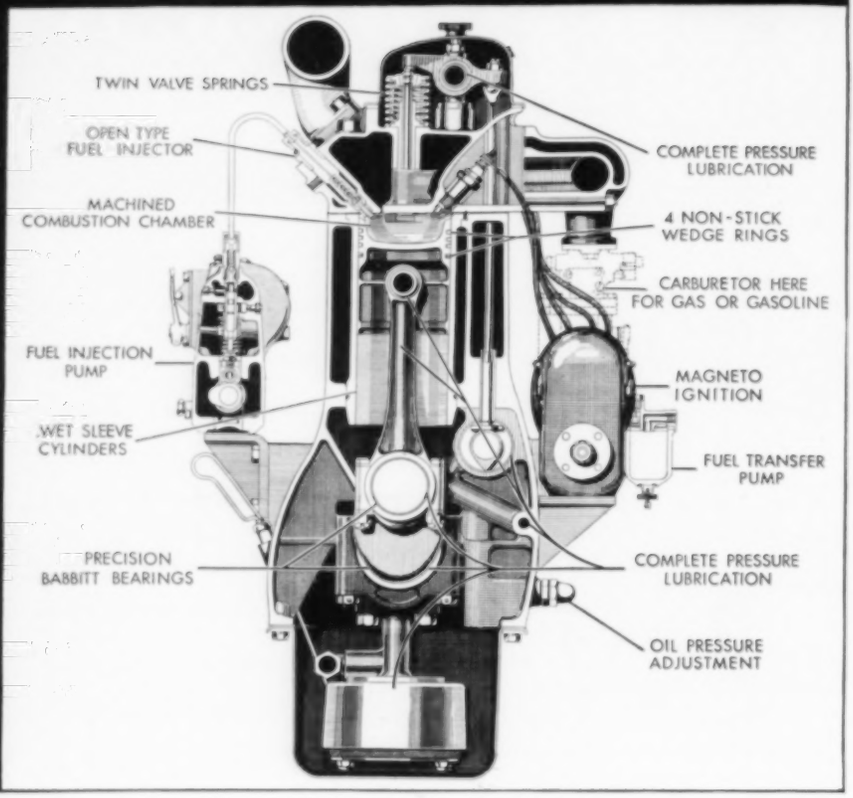

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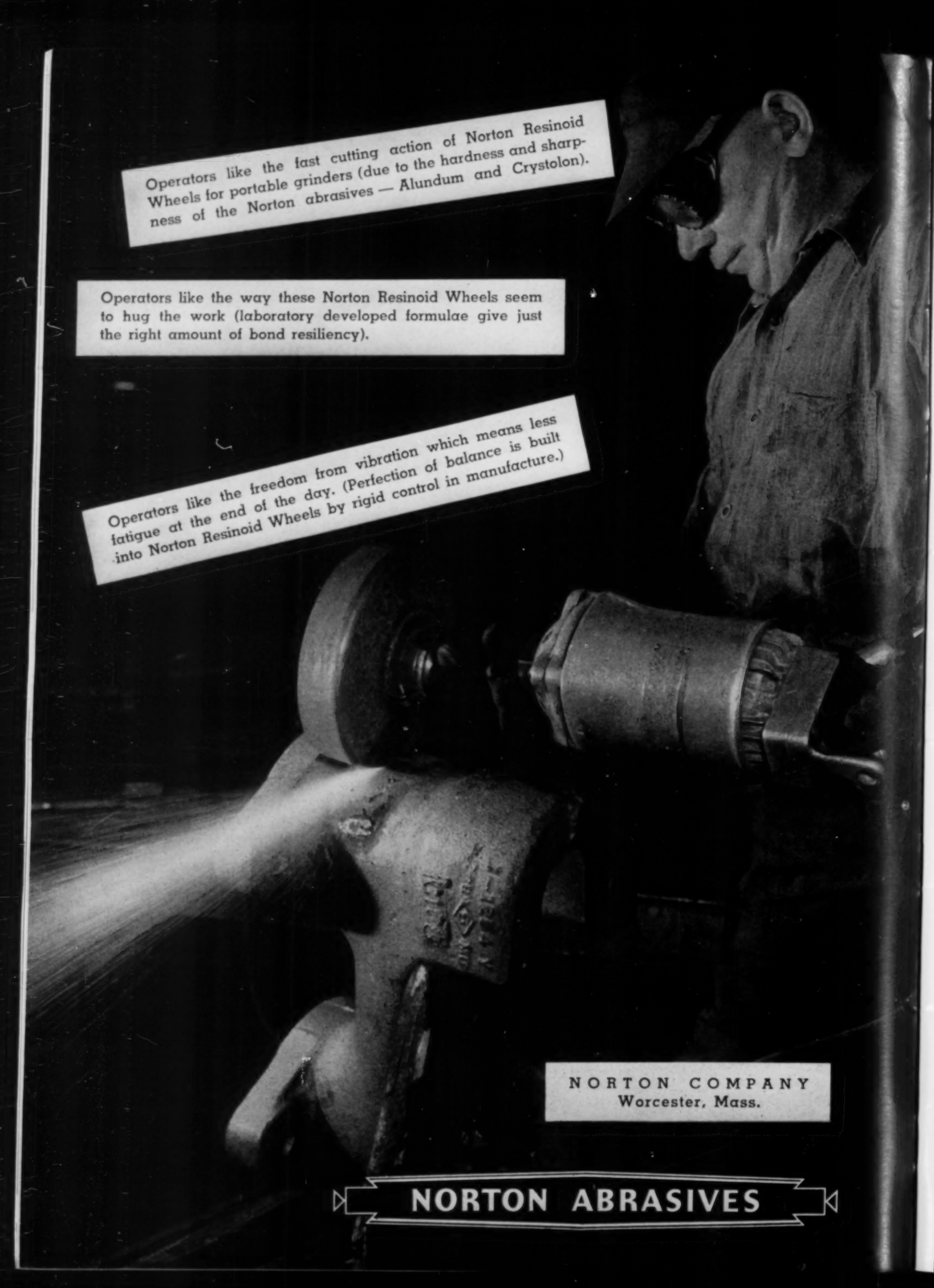
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ON THE COVER

OUR cover picture shows a sponge diver at Tarpon Springs, Fla., which is the center of the sponge industry of the United States. This work is conducted by Greeks and Portuguese, who make up virtually the community's entire population. Sponges have been utilized by man since long before the Christian era. Only about a dozen varieties are commercialized, although thousands are known. This picture illustrates improvements that have been made in recent years in the flexibility and comfort of the diver's dress. Compressed air is, of course, vital to him, and is supplied through the hose connection at the helmet.

•

IN THIS ISSUE

BOTANISTS call it *Arachis hypogaea*. In Brazil it's the *mani* and in Peru the *anchic*. English-speaking peoples know it variously as the earthnut, the groundnut, the pinda, or the goober. To most of us it is the peanut. Call it what you will, it is one of America's favorite tidbits. Once merely something to munch at the circus or ball game, it is growing in the esteem of the dietician as an important source of protein, vitamins, and minerals. The biggest name in the realm of peanuts is Planters, which processes millions of them daily. Our leading article traces that concern's growth.

•

THIN sheets of wood, bonded together securely, make a stronger and better-appearing board than a solid piece of lumber. Consequently, plywood is being utilized more and more all the time. Most of it comes from the Douglas fir forests of the Northwest, where new processing plants have been springing up almost monthly to meet the demand for this laminated building material. *Wood Sandwiches* takes us inside one of these mills.

•

ALL the elements of a motion picture are contained in *A Couple of Small-Town Boys*. Adversity, sudden wealth from oil, a boundary dispute, profligate spending, hair-trigger decisions, 12-ton compressors shipped 2,000 miles by express—these, plus the story of how some of the nation's largest petroleum concerns started, give a Hollywood twist to a true narrative with a Texas setting.

•

THINKING that the making of gas would interest people in his community, J. J. Crilly of the Elizabethtown Consolidated Gas Company had some large drawings made to illustrate the process, polished up a 25-minute talk, and started the rounds of luncheon clubs and civic bodies. The response was favorable. We borrowed Mr. Crilly's drawings long enough to photograph them, and they are presented in this issue along with explanatory notes.

Compressed Air Magazine

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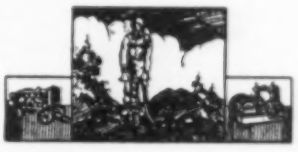

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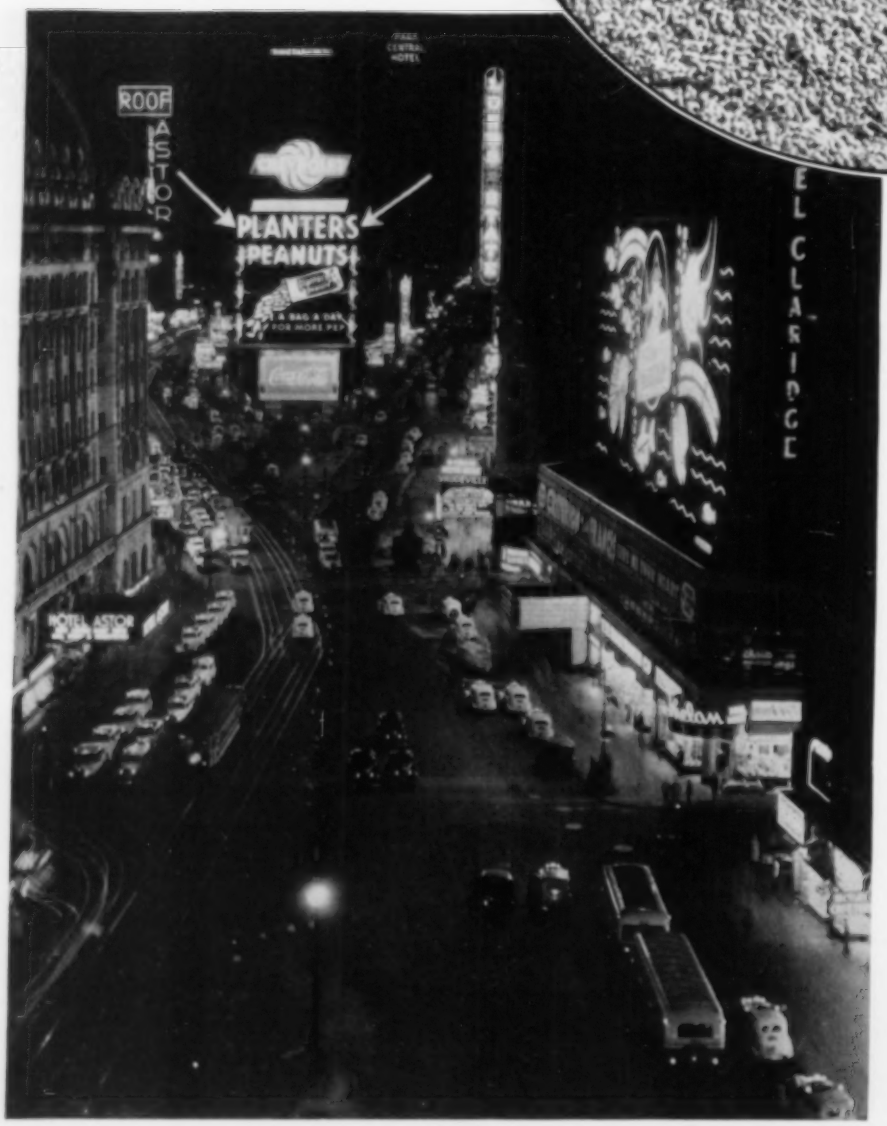
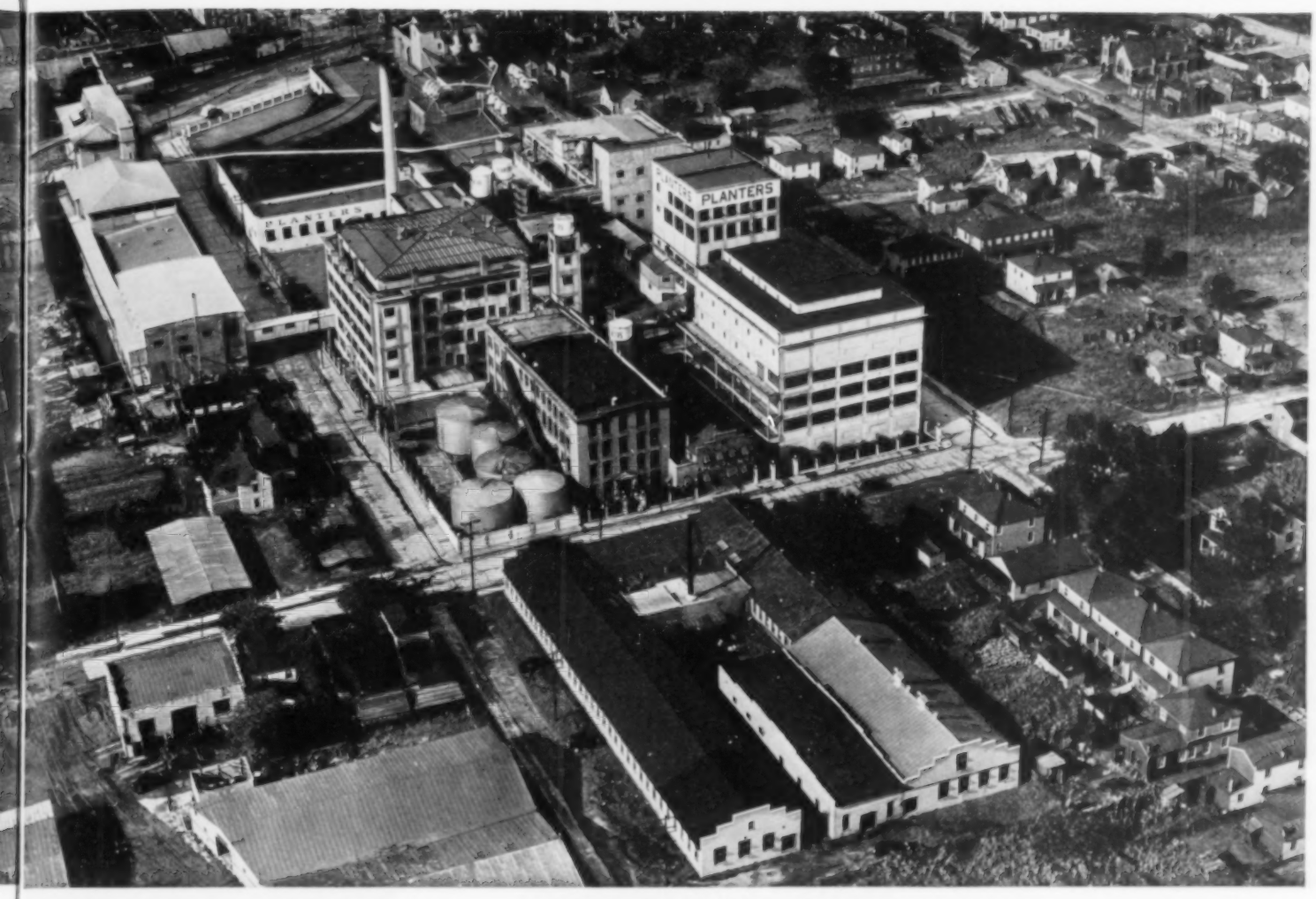
The Popular Peanut

Allen S. Park



THERE is a statue to the boll weevil in Enterprise, Ala. It was erected in 1919 at a cost of $3,000 "in profound appreciation of the boll weevil and what it has done as the herald of prosperity." The weevil did Enterprise a good turn by forcing the farmers of the area to forsake cotton growing for the raising of peanuts. The lowly goober proved to be so much more profitable that public funds were voted for the memorial to the weevil.

The peanut now ranks fifth among the crops of the South in point of monetary value, and in some individual states it holds a higher place. The 1940 crop exceeded 600,000 tons, and brought the farmers more than $40,000,000. Listed in the order of their importance, the principal producing states are Georgia, North Carolina, Alabama, Virginia, Texas, and Florida. These six contain approximately 80 per cent of the acreage planted to peanuts. In the entire United States some 450,000 farms grow peanuts on approximately 1,900,000 acres. Peanuts are cultivated in more than 30 countries, notably in British India, China, and Senegal. In China, they are an important food.



PEANUTS IN VIRGINIA AND NEW YORK

The outgrowth of a peanut-cleaning establishment purchased in 1912—the Planters plant in Suffolk, Va. It now covers sixteen acres, includes more than 50 buildings, and employs in excess of 1,000 persons. The company's first product, Pennant Brand whole salted peanuts, accounts for nearly half the total annual sales of $10,000,000. Planters markets its line through thousands of retailers and also conducts its own chain of 39 stores under the name of the National Peanut Corporation. A 55x49-foot electric sign at Forty-seventh Street and Broadway tells strollers on New York's Rialto to eat more peanuts. At Suffolk pretty girls were buried in goobers during the festival held in January.

The peanut is not a nut at all, but a pea that has a nut-like flavor. The plant is a legume. The so-called nut is the seed, and it is produced in pods which grow underground, thereby differing from those of any other legume. The plant has a yellow bloom with five petals. After the bloom withers and drops off, a needlelike shoot appears, turns downward, and thrusts itself into the ground. There it develops into a single pod. On bunch-type plants the pods occur in clusters: on runner types they are more scattered. A single plant will yield from 25 to 50 pods.

The origin of the peanut is not definitely known. Designs of the vines have been found on Inca jars dating from around 950 B.C., and actual nuts have been taken from prehistoric graves near Ancon, Peru. The plants still grow wild in Peru and Brazil. It is assumed that nuts were carried from those countries to the Orient and to Africa by early explorers and missionaries. They were brought to the United States by slave ships, it being reported that peanuts were used as food for the slaves during the voyage and also to some extent for a short time after their arrival.

But, although the vines flourished in many gardens in the South, little effort was made to commercialize the peanut until after the Civil War. The reason for this was that relatively few men owned all the land and farmed large tracts on which they could make a good living raising cotton. The plantations were divided up after the war; and as the soil had become impoverished from continual cotton growing, diversification of crops became a necessity. It was at that time that Virginia farmers started planting peanuts. Other southern states gradually followed their example, especially after the boll weevil crossed the Rio Grande River into Texas in 1891 and infested the cotton plants in one after another of the states.

The demand for peanuts was small at first, and a market had to be created for them. They were originally obtainable only in the shell, principally at street stands, and not many people bought them. In 1870, P.T. Barnum allowed a hawker to sell them at his circus, and that popularized them, especially with the younger generation. Salted peanuts were introduced in 1887. They were principally the small, round, Spanish variety which was and still is marketed with the inner, red, paperlike jacket on them. A slot machine for vending peanuts made its appearance in 1900, and in the same year they were first used in candy bars. Then followed the blanched, salted peanut, peanut butter, and peanut oil.

Until recently, little emphasis was placed on the food value of the peanut, which people ate merely because they liked the taste. Now, however, it is recog-

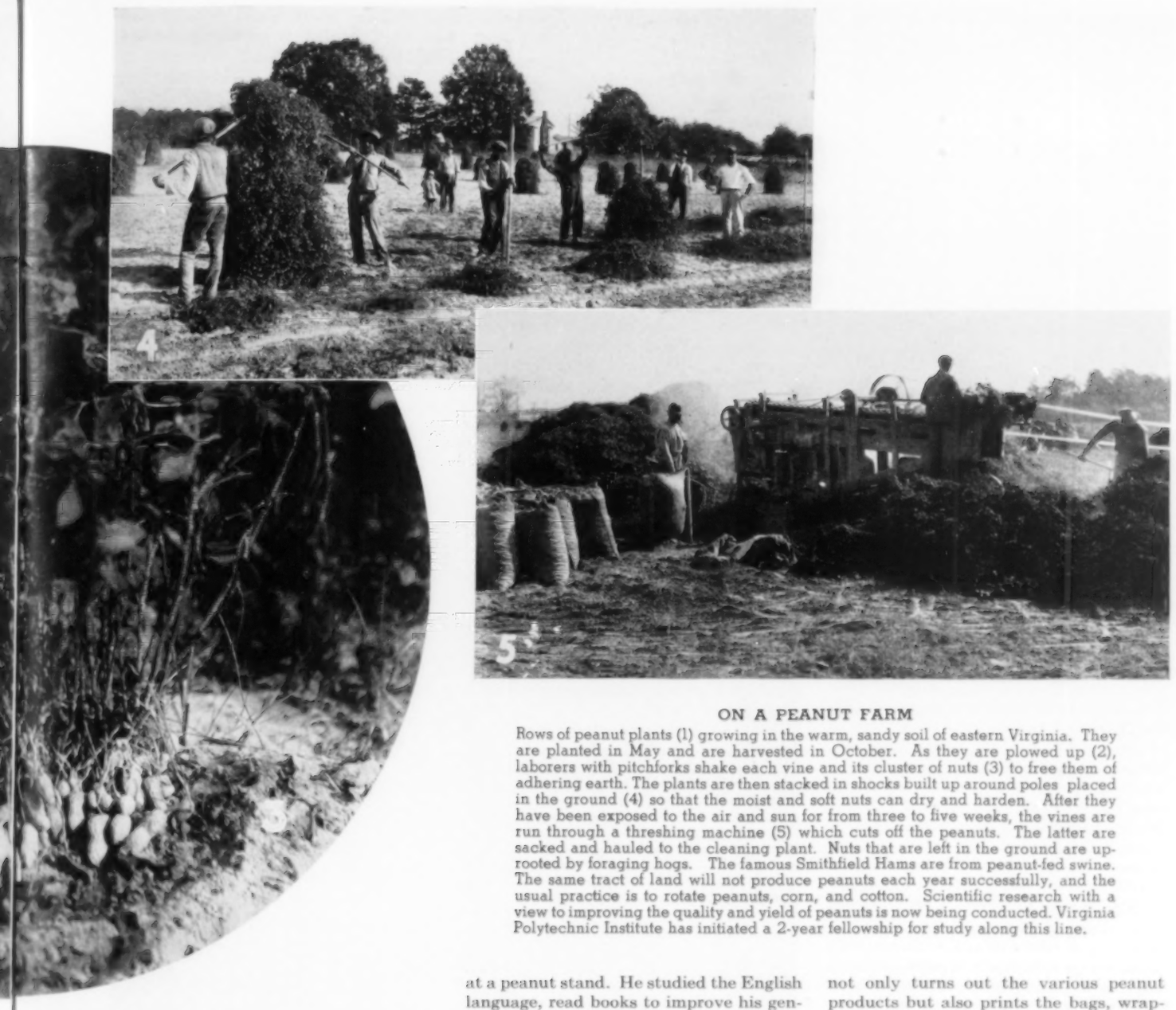
Photos Hamblin's Studio

nized as an important source of vitamins A, B, and C. As an energy producer it ranks high, containing around 2,500 calories a pound, as compared with less than 1,100 for beefsteak. It is also said to be higher in iron content than raisins. New nonedible uses for the goober and its products are being found all the while. Dr. George W. Carver, renowned colored scientist at Tuskegee Institute in Alabama, has discovered more than 180, and among them are medicinal preparations for the treatment of pellagra and infantile paralysis. Peanut oil has long been an ingredient in oleomargarine and high-grade soaps, and during the first World War was used for making glycerine. It is now coming into favor as a cooking and salad oil. The U. S. Department of Agriculture ranks it first in digestibility among all fats and oils.

Nine varieties of peanuts are grown in the United States, but only three are commercially important. These are the large-podded Virginia, which has the best flavor; the Spanish, which is small but contains the highest percentage of oil (up to 50 per cent); and the Georgia Runner, which is similar to the Virginia but not so widely cultivated. The plant thrives best in sandy loam in areas of comparatively light rainfall during the growing season. The soil must be well drained and "sweet." As peanuts require from 125 to 130 days to mature, there must be an interval of at least five months between frosts. High altitudes are unfavorable, because of the cool nights. In general, wherever climatic conditions are favorable, any land that will produce 30 bushels of corn to the acre will grow a profitable peanut crop. The average yield per acre varies greatly in different sections of the country, ranging from less than 500 pounds in Louisiana, Oklahoma, and Texas, to more than 1,000 pounds in Virginia and North Carolina. The last-mentioned states excel because of better farming methods, suitable soil, and also because they have developed the larger and heavier jumbo variety of Virginia nut.

Peanuts are planted soon after the frost is out of the ground. Two or three kernels, their skins unbroken, are deposited by machine in a hill and at a depth of about 1 inch. Hills are about 1 foot apart and are arranged in rows approximately 3 feet apart. The plants, of olive-green color, grow about 18 inches high; and after the small yellow flowers resembling pea blossoms have come and gone, the stems or pegs turn downward and force their way into the soil, as previously mentioned. The crop ripens in October, and the vines, with the nuts adhering to them, are dug up usually by plowing. At this stage the shells are damp and soft and the kernels are milky and must be cured by exposure to the air for from three to five weeks. This is accomplished by stacking the vines in shocks in the field. The frame for a shock is a pole about 7 feet long with two sticks, each about 18 inches long, nailed to it in the form of a cross or platform about 20 inches from one end. That end is sharpened, and is thrust into the ground from 12 to 14 inches. Laborers with pitchforks follow the plow, shake the plants to remove excess dirt from the pods, and then stack them. A few are laid on the cross sticks, and others are placed on top of them until the shock is completed. The pods are thus held off the ground and exposed to the air. After they have become hard shells and the kernels are firm, the vines are run through a threshing machine where the nuts are separated and run into burlap bags holding about 90 pounds each. The plants are baled and used for stock feed.

As they come from the field, the peanuts are dirty, bits of taproots are attached to them, and pieces of vines are mixed with them. The first step in processing them, regardless of the form in which they will



ON A PEANUT FARM

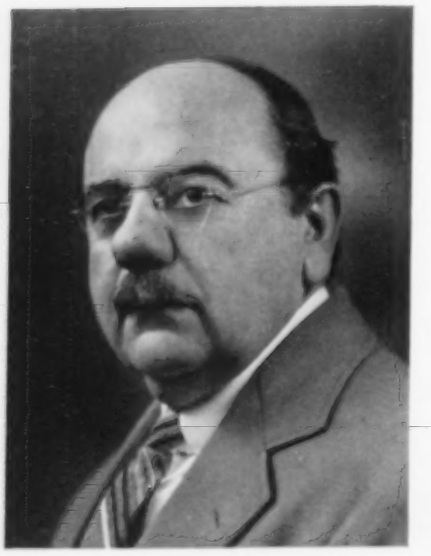
Rows of peanut plants (1) growing in the warm, sandy soil of eastern Virginia. They are planted in May and are harvested in October. As they are plowed up (2), laborers with pitchforks shake each vine and its cluster of nuts (3) to free them of adhering earth. The plants are then stacked in shocks built up around poles placed in the ground (4) so that the moist and soft nuts can dry and harden. After they have been exposed to the air and sun for from three to five weeks, the vines are run through a threshing machine (5) which cuts off the peanuts. The latter are sacked and hauled to the cleaning plant. Nuts that are left in the ground are uprooted by foraging hogs. The famous Smithfield Hams are from peanut-fed swine. The same tract of land will not produce peanuts each year successfully, and the usual practice is to rotate peanuts, corn, and cotton. Scientific research with a view to improving the quality and yield of peanuts is now being conducted. Virginia Polytechnic Institute has initiated a 2-year fellowship for study along this line.

reach the consumer, is to clean and grade them. Cleaning establishments are located in all the growing areas; but the country's recognized marketing center is Suffolk, Va., which turned over $25,000,000 worth of peanut products last year.

In Suffolk is the principal factory of the Planters Nut & Chocolate Company, the largest processor of peanuts in the world. This well-known concern, which does a $10,000,000 business annually, stems from a street-corner peanut stand in Wilkes-Barre, Pa. It is still directed by the men who started it, Amedeo Obici and M. Peruzzi. Mr. Obici came to the United States from Italy as a steerage passenger when he was eleven years old. He lived for a time with an uncle in Scranton, Pa., and worked for $1 a week. Before long he moved to the neighboring city of Wilkes-Barre and obtained employment at a peanut stand. He studied the English language, read books to improve his general education, saved his money, and in a few years succeeded in launching his own peanut-vending business.

Mr. Obici became known in Wilkes-Barre as the "peanut specialist"; and in 1906, with Mr. Peruzzi, formed the Planters Peanut Company. They rented a building for $25 a month; put in two roasters and some crude machinery; and started operations with a force of five girls and one man. At that time the popular salted peanut was the small Spanish variety with the red skin. Mr. Obici introduced whole blanched, or skinned, Virginia nuts, and the public liked them. Peanut bars, peanut butter, and chocolate-peanut confections were added to the line, and the factory expanded. The firm began buying nuts from Suffolk in carload lots; and in 1913 a peanut-cleaning plant was purchased there. It formed the nucleus of the present large factory, which not only turns out the various peanut products but also prints the bags, wrappers, etc., in which many of them reach the market, and the advertising and sales literature. Other plants are maintained in San Francisco, Calif., and in Toronto, Canada. The executive offices are in Wilkes-Barre, from where Mr. Peruzzi, as vice-president, treasurer, and sales manager, directs the selling organization. Mr. Obici, the president and general manager, has had charge of the manufacturing operations from the outset, and he makes his home in Suffolk. Since 1916 the concern has been an aggressive national advertiser. In that year an employee created "Mr. Peanut," the trademark figure that has become known throughout the world.

The factory uses seven grades of Virginia peanuts: Jumbos and Fancies, which are sold in the shell; Extra Large, which are salted and packed in vacuum-closed tins as well as in paper or cellophane bags; No. 1 which are sold to candy manufacturers;



AMEDEO OBICI

An emigrant from Italy at the age of eleven, Mr. Obici started in the peanut business with his own stand in Wilkes-Barre, Pa. In 1906 he and M. Peruzzi launched the Planters concern, which is now the largest of its kind in the world.

No. 2, which are made into butter; and others which are crushed to extract the oil. The price the farmer receives varies with the grade and also depends upon the size of the shells, their cleanness, and their firmness. Most growers sell their crops before Christmas; and to take care of the huge stock of raw nuts carried, Planters has erected 36 warehouses in Suffolk.

At the cleaning mill the sacks are opened and the nuts are dumped into a hopper and elevated to the fifth floor. Stemming machines remove the taproots and stems, and these, as well as trash, are blown out by streams of air. Some shells contain only one kernel: the nuts of others are not well developed. These look all right externally, but are underweight. Currents of air lift and separate them from the sound nuts, which pass over perforated revolving screens that grade them into three sizes. The latter are then delivered to picking tables, where belts convey them past Negro women who remove those that are discolored and that are irregularly shaped, as well as foreign matter that may have escaped the machines. Peanuts that are to be sold in the shell are then tumbled to give them a smooth, clean polish.

Nuts that go to the factory for processing are first shelled at the cleaning mill. The sheller is a cylinder with an internal, revolving shaft providing just enough clearance to exert the right amount of pressure to rasp off the shells without separating the kernels into their respective halves. By previously sorting the nuts into three sizes it is possible to distribute them to shellers that are properly set for this work. Shells enter into the preparation of meal for feeding livestock, are used as bedding for stock, as a polishing material in steel mills, and as a filler in some explosives.

Electric trucks transport the shelled nuts to the factory in bottom-dump containers holding about 2,000 pounds. After being weighed, they are run into an elevator, lifted to the fifth floor, and emptied into bins. From that point they flow through the plant mostly by gravity. The first step is to give the nuts a light roast and then to cool them quickly in the air. This serves to loosen the skin, which is blown off by currents of air. The blanching process, as it is called, does not remove all the skin from every kernel. The segregation of those to which a part of the covering still adheres was formerly a manual operation carried out on picking belts. It is now accomplished by ingenious machines that make use of the electric eye. They are built by the Electric Sorting Machine Company of Grand Rapids, Mich., and have been employed in recent years for handling not only peanuts but also peas and beans. More recently they have been adapted for sorting lemons and coffee beans. The separation is made on the basis of color, the machine rejecting any dark-colored fruit or kernels.

The sorting machine has twelve revolving wheels arranged in a line on each side, or twenty-four in all. At intervals around the periphery of each wheel are small round openings. Vacuum applied within the wheel creates suction which causes a peanut to be drawn into each opening as the wheel passes through a pile of nuts. So held, each is presented to the photoelectric mechanism, which views it from both sides at the same time. If a piece of dark skin remains on either side of it, a pin moves against it and pushes it out, the kernel falling down a chute into a container. Peanuts that show no discoloration are carried around to a point where the vacuum is released and drop on to a traveling belt that conveys them to the forward end of the machine. The nuts are fed into the top of the sorter and are then directed to the various wheel stations. Before entering the mechanism

THE PEANUT QUEEN

As a part of the program launched by the National Peanut Council to make America more peanut conscious, Miss Betty Cross was crowned queen of the first National Peanut Festival held in Suffolk last winter. The U.S. Department of Agriculture estimated that the 1940 peanut crop exceeded the demand by 175,000 tons. Most of this surplus was attributable to increased peanut growing in Georgia and Texas where farmers are switching from cotton. Suffolk, the world's largest goober market, is supported largely by peanuts. It has 22 cleaning plants capable of handling a total of 18,000 bags daily.

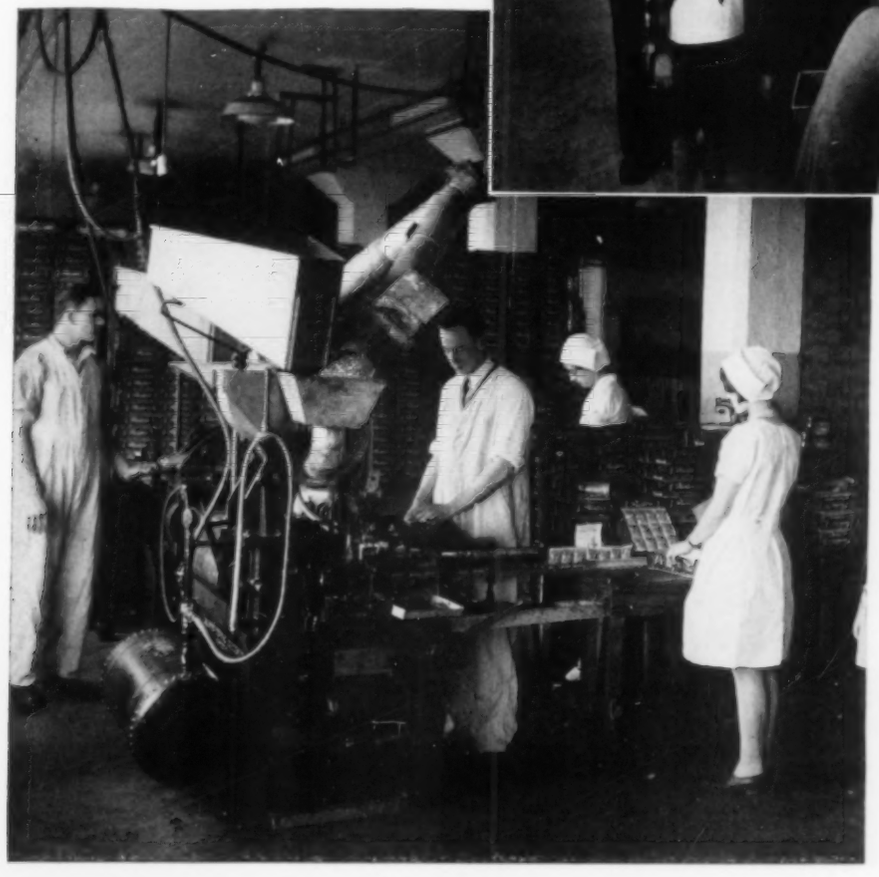
they go over a perforated oscillating screen to separate the half kernels, which are sorted by two similar units in the candy department. The vacuum for the sorting machine is induced by an Ingersoll-Rand Type FS single-stage blower that is connected with its intake. The blower has a capacity of 1,000 cfm. and is driven at 3,500 rpm. by a General-Electric 15-hp. motor.

Nuts passing out of the sorting machine on the conveyor belt are visually inspected by trained workers. Any peanuts with small pieces of adhering skin that have escaped the electric eye are removed at this stage of the processing. The inspectors also pick out any shriveled or otherwise imperfect kernels. At the discharge end of the belt the nuts are examined under a huge magnifying glass. It so happens that a stone, resembling a peanut in size, shape, and color, occasionally gets into a bag in the field and thence into the factory. These are detected and removed at this point; but, as an additional precaution, all boxes of finished products are run through an X-ray chamber before shipment. Any stone shows up clearly there, and the box is rejected.

Only whole kernels are used for Planters salted peanuts. They are cooked in vegetable oil in special continuous-type apparatus, and the requisite amount of salt is added there. They are vacuum packed in ½- and 1-pound tins and are also put in laminated glassine bags and in small cellophane bags retailing, respectively, for five cents and one cent. A recent addition to the Planters line is a vacuum-packed tin of cashew nuts. These are grown in India and arrive at Suffolk in sealed tins holding 28 pounds each.

Half kernels of peanuts enter into the making of candy bars. The candy part of this confection consists of an exactly proportioned mixture of corn syrup, sugar, and water which is cooked for a specified time in small copper kettles in which the heat is accurately controlled. The nuts are stirred in at the end of the cooking period, and the plastic mass is emptied into a rectangular metal frame resting on a marble-topped table. It is then flattened out by rolling, each batch being just large enough to fill the frame. The slab thus formed is cut into package-sized bars which are ready for wrapping after a few minutes of hardening. Wrapping is done both by hand and machine.

Peanut butter is made by grinding roasted nuts and adding only pure table salt during the process. The butter is run into sterilized jars and sealed. Although Planters makes peanut butter for established customers, it is a relatively unimportant product with the company. The output of peanut oil, on the other hand, is steadily growing in importance. The oil is colorless and odorless and does not become rancid. It has been widely substituted for olive oil, especially since that commodity has risen in price. Peanut oil is suitable for cooking because it produces no smoke. It is desirable that the nuts used for the purpose be well matured in view of the fact that the oil content increases rapidly towards the end of the growing season. Mature Virginia nuts are approximately 45 per cent oil. This is contained in sacs which must be broken down by crushing to extract it. The raw oil is purified by a double refining process and is marketed in cans of varying sizes. Although Planters has been producing peanut oil for eight years, it is not yet supplying it to all parts of the country. The residue from the oil-extraction process serves as a meal for feeding livestock.



PLANT OPERATIONS

Although machines do much of the work of cleaning and sorting peanuts, hand sorters (above) are still important, and up to 70 of them are employed at Planters. Only clean nuts are wanted for marketing in the shell. If rains prevail during the digging period, many shells are discolored and twice as many sorters as usual are required in the cleaning plants. A large proportion of Planters salted peanuts is marketed in laminated glassine paper bags that are made and printed in the plant. At the left is shown an automatic bag-filling machine. The tank at its left end is a receiver for compressed air which is used to blow the bags open just before they are filled.

Wood Sandwiches

Henry W. Young

PEELER LOGS

Douglas fir logs, from 4 to 8 feet in diameter, in the pond of a plywood mill, in which they will be processed. They are called peeler logs because the thin sheets that go to make up plywood are actually peeled from them.

SUCH is the nature of that thing called public acceptance, or public consciousness, that it usually smolders for a long time and then flares up into a veritable conflagration. Something like that is happening in the plywood industry right now. For the past quarter of a century people have been familiar in a vague way with various veneers, wallboards, and the like. The applications of these laminated materials were very limited until of late years, when they suddenly forged ahead because of improvements in the quality of the product.

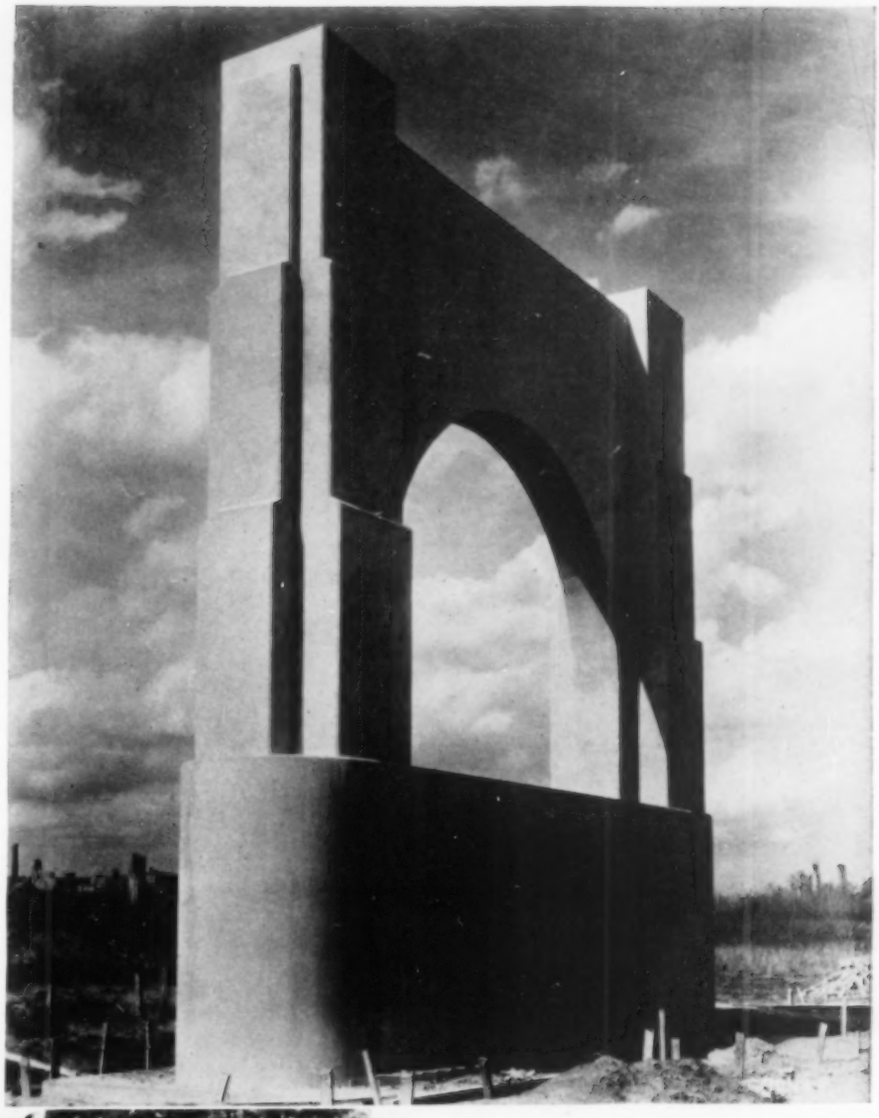
The story of plywood is an interesting one of a supposedly modern, scientific development. In its present form the material is, indeed, ultramodern. But it has its predecessors that go far back in history. Specimens of Egyptian and Chinese furniture, now museum pieces, were built on the plywood principle and have survived a score or more of centuries in testimony of the skill of the ancient craftsmen.

Plywood has as its present foremost representative the product manufactured from the American Douglas fir (*Pseudotsuga taxifolia*), which is found in a limited "strip" of territory in the western part of Oregon and Washington. These kingly trees, when full grown, stand 200 to 300 feet high and have an average diameter of 6 to 8 feet, with many specimens 12 and more feet through. Towering in the dense, almost tropiclike forests above other trees, they shoot up seeking their place in the sun with scarcely a limb in the first 100 or 200 feet. Consequently, they have trunks that are well-nigh free from knots. The rich soil, heavy rainfall, and lack of high winds in the area produce a wood of uniform ring growth, light weight, light color, and extraordinary strength that is ideally suited for the manufacture of plywood.

In the region mentioned, are located some of the world's largest plywood plants, no less than six of them having been constructed and put into operation since the spring of 1940. They represent an outgrowth of the first small Douglas fir plywood mill built at St. Johns, Oreg., in 1905. For many years afterward, the

industry constituted nothing much more than small departments in door factories. Now it has its own trade association, known as the Douglas Fir Plywood Association, with the slogan: "The Modern Miracle in Wood—Pound for Pound Stronger than Steel."

Quoting from a recent bulletin of the Forest Products Division of the U.S. Department of Commerce, Douglas fir plywood is defined as: "An engineered wood board or panel consisting of an odd number of sheets of Douglas fir veneer placed crosswise and bonded together under hydraulic pressure with water-resistant glues which are stronger than the wood itself." It is estimated that laminated wood has already been put to more than 2,000 distinct uses. No effort will be made to enumerate them here: it is sufficient to say that they cover widely diversified fields from making concrete forms, boxcar linings, radio cabinets, packing cases, and outdoor signs to building homes, industrial structures, cantonments, boats, and so on. With the development of synthetic resin-base glues that are so highly water resistant that the wood can be exposed to the elements even in humid, tropical climates, the applications have been increased many fold, and you can now make the outside as well as the inside of your house of the "miracle wood." Engineers have long known that plywood, with each sheet laid with the grain at right angles to that of the overlying sheet, has exceptional strength and rigidity. But it was satisfactory glues that they needed; and after ceaseless laboratory research they were finally discovered.



Photos from Douglas Fir Association and Evans Products Co.

USES OF PLYWOOD

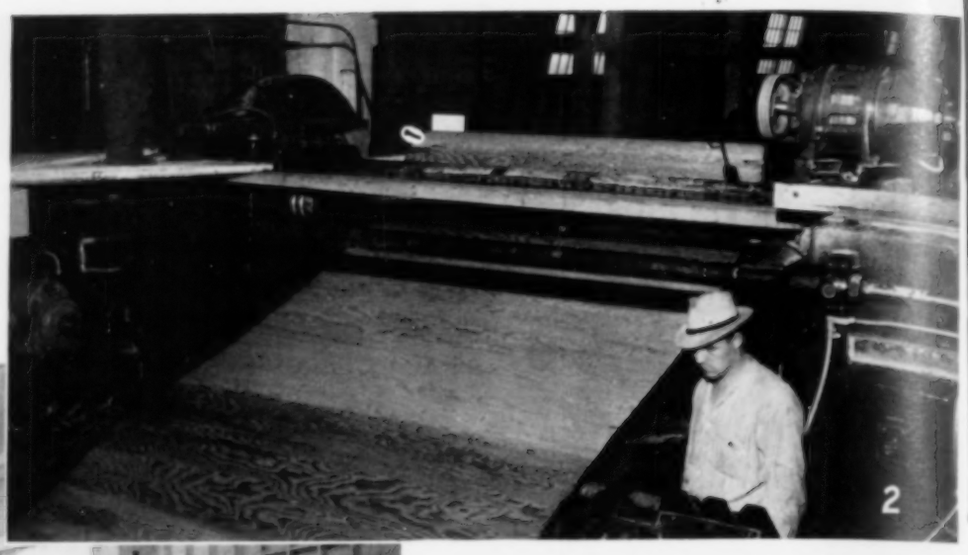
The smooth, unblemished surface of the bridge pier was obtained by pouring the concrete in plywood forms. The house, one of many sponsored by *Life* magazine, owes its pleasing modern touch to the utilization of plywood.

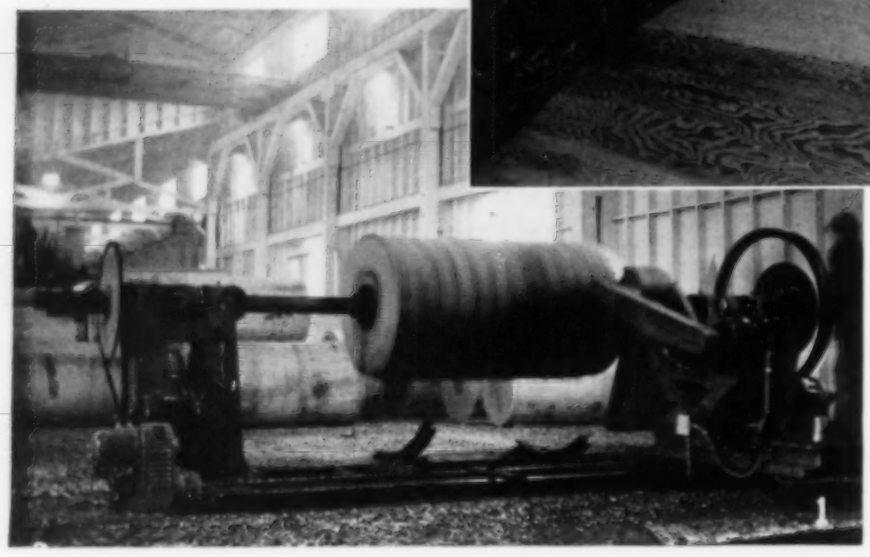
As a result of the improvements in laminated wood, the annual production has been climbing at a steady rate. In 1940 a total of approximately 1,500,000,000 square feet (on a 3/8-inch-thick basis) of Douglas fir plywood was manufactured in western Washington and Oregon in 25 huge establishments. This is in contrast to 880,000,000 square feet in 1939 and 640,000,000 square feet in 1938. How much is 1,500,000,000 square feet? Someone with time on his hands figured it out once. It represents a plywood sidewalk 4 feet wide encircling the earth more than two times at the equator.

In spite of the fact that at least half a dozen large-size plants were constructed in the area in 1940, each went into full-capacity production as soon as it was

IN A PLYWOOD MILL

1- The whirling log is debarked. 2- The log is peeled into a continuous sheet a fraction of an inch thick. 3- Under fluorescent lights the clipper cuts the ribbon of wood into sheets. 4- From three to seven sheets are glued together, and groups of these are then compacted into panels in a huge hydraulic press that exerts a squeezing pressure of 200 pounds per square inch. 5- From the sander come the finished panels, their surfaces smoothed and their edges trimmed and squared.





completed, and the present consumption outstrips the supply. The demand for home building and industrial uses hit an all-time high when along came the defense program calling for literally acres of plywood. Every machine and every man is straining. What at? What is the process by means of which this pound-for-pound-stronger-than-steel wood is made?

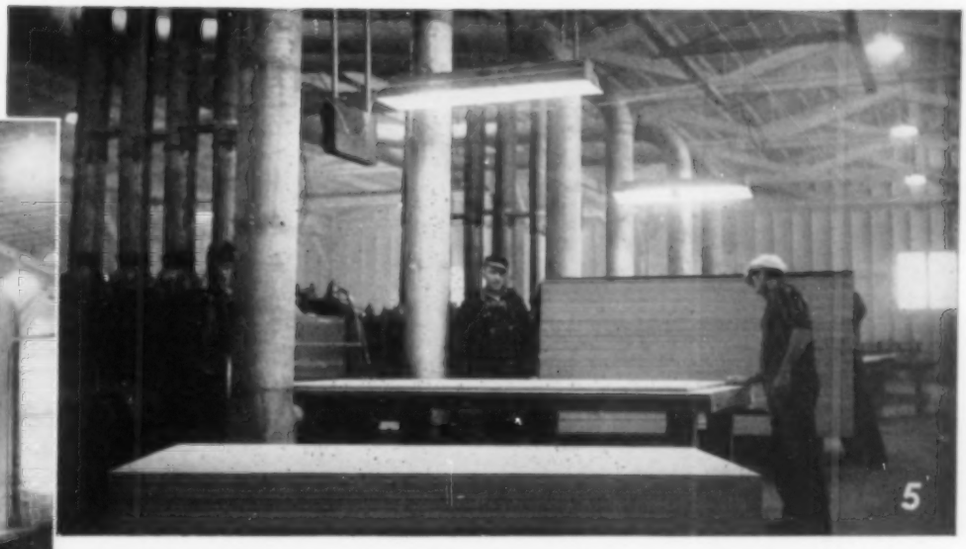
Starting with the Douglas fir, it is not as a rule found by itself in large forests. It grows together with other trees; and what is known as selective logging is practiced. The logging and lumber companies lay aside such of the firs as are suitable for "peeler logs" and sell them to the plywood mills. They are brought out either by logging railroads or trucks and dumped into the plant's storage pond. There they are poled to the bucking saw which cuts them into 6-, 8-, 10-, or 12-foot lengths, depending upon the panels to be made. These sections are called "peeler blocks" or "veneer blocks," and they are picked out of the water at the entrance to the mill by an overhead crane that transports them to the first machine. This is a lathe for removing the bark, which has an average thickness of 5 or 6 inches.

The log is centered on the center of growth of the block, which usually is not the geometric center. But the beamlike arm, carrying the cutting tool, is mounted so that, as it moves back and forth on its carriage from end to end of the block, the knife follows the general contours of the surface, much on the principle of the ordinary apple parer. Four or five passes are generally sufficient to remove the bark down to the clear wood. The crane then takes the block to the main lathe or "peeler."

The machine that produces the veneer has a long knife that extends the length of the block. As the latter revolves, a thin strip, say ⅛ inch thick, is cut off, the thickness depending upon the plywood to be made. The surface of the block not being round, narrow slices are first cut, and these grow wider and wider as the block nears roundness. The first pieces may be wasted; but as they reach workable width they are sent by conveyors to points ahead where they are manufactured into plywood.

When a peeler block has been turned down to true circular form, the veneer comes from the knife in a continuous strip—in fact, it is then literally "unwound" like newsprint from a roll. Traveling on a belt conveyor, the strip reaches the clipping machine, a manually operated "guillotine" that chops it into short lengths. It also cuts out sections that have pitch pockets or other bad defects. This is done as the sheet moves along, the faulty wood being discarded. From the clipper the pieces are carried by conveyor into a mechanically controlled drier where they are subjected to a temperature of approximately 250°F. in reducing the moisture content of the wood from 50-60 per cent to 6-10 per cent. When the veneer leaves the drier it is too hot to handle, so it is cooled on the sorting conveyor with a fan, which is part of the drier equipment.

After the material has been graded comes the glue application. Each sheet is passed through rolls which spread the glue evenly on one or the other side, whichever may be preferred. From the rolls it is fed on to a large table on which has been placed a similar but unglued piece of stock upon which are built up as many plies as may be desired with the grain of each sheet running at right angles to that of the one directly below it. The bundle is now ready for the hot press, where, together with many others, it is subjected to heat and hydraulic pressure ranging from 100 to 200 pounds per square inch, depending upon the kind of glue that is being used. In the most modern presses



it takes only four or five minutes to set the glue. Then the charge is taken out and a new one put in.

Inspection of each piece of plywood follows. In the case of the best grades, very small knots are removed from the surface layers by cutting them out with a curved chisel, one blow on each side forming an oval. A shim of the same shape and cut with the same chisel is then glued and inserted; the edges are trimmed; the corners are squared; and the panel is passed through a sanding machine that gives it a perfectly smooth and satinlike finish. Before the material goes to the warehouse it receives a final inspection.

The foregoing is the simplest possible description of a mill's general routine which, however, has many ramifications, thus making for a complicated factory schedule. This is accounted for by the different grades and thicknesses of plywood produced and the use of various kinds of glue. Furthermore, the veneer as it is unwound is not of uniform width. Narrow pieces must therefore be placed edge to edge and be taped to make wider ones before gluing and pressing.

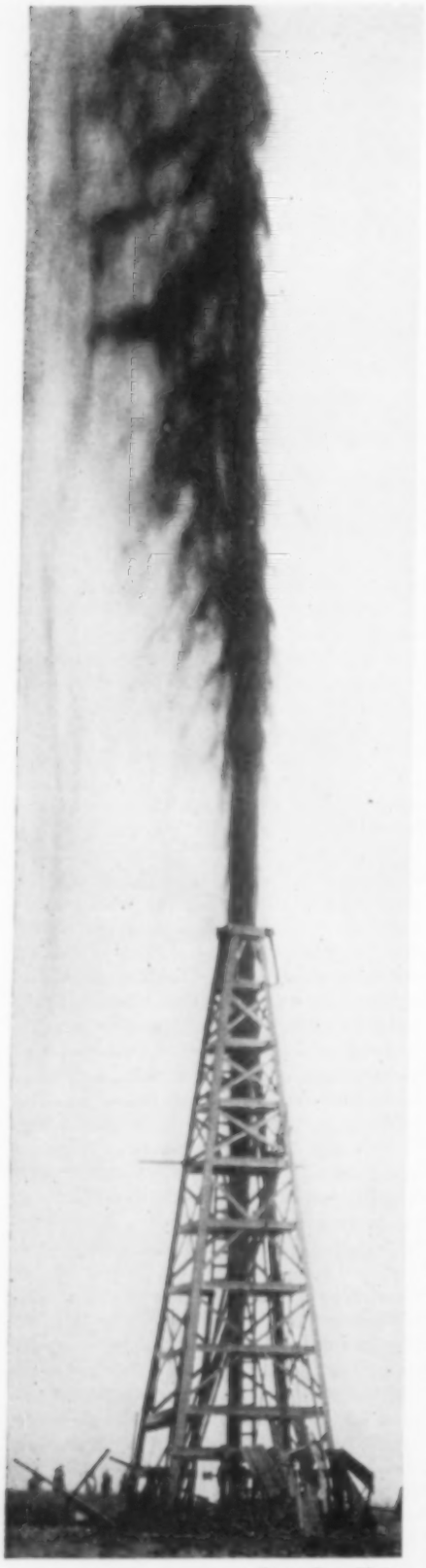
Plywood is thought to be the answer to the problem of the prefabricated house in view of the fact that it permits a certain amount of individuality in structures of this sort. The recently developed "Dri-bilt" system is based on the use of plywood throughout, both exterior and interior. Wall and ceiling panels are prepared in the shop for assembly, a tight bond between sections being assured by an ingenious spline joint. The spline is an integral part of each panel, and when fitted into a preformed slot in the adjoining one is both nailed and glued in place.

In the usual type of building for residential purposes, plywood may be used in a variety of ways: for sheathing, as an exterior as well as an interior finish—in the latter case in place of plaster, as partitions, subflooring, or a base for linoleum. If both sheathing and inner walls are of plywood, a dead-air space is assured between the two because of the closeness of the fit and because there is not the slightest hole anywhere in the laminated wood. This construction therefore affords a high degree of insulation. Furthermore, the nature of the material is such as to make for a structure of exceptional rigidity. Tests conducted at the Forest Products Laboratory in Madison, Wis., have proved that a plywood wall, using standard 4x8-foot sections, is 5.9 times more rigid than one of conventional horizontal sheathing. Other tests have shown that $\frac{5}{8}$-inch panels, on joists 16 inches apart, will support a floor load of 500 pounds per square foot and be deflected less than 0.04 inch. For purposes of interior decoration, different treatments may be employed—staining, painting, enameling, plastic painting, bleaching, and papering.

Plywood for concrete forms that play an essential part in the heavy-construction field, including dams, bridges, tunnels, and the like, is of special and extra-special quality, depending upon the service to which they are to be put. The extra-special is for forms that are to be used over and over again until they are nearly worn out, or that are to be employed in humid, tropical climates. All such panels are oiled and have sealed edges, work that is done at the mill. Where curved sections are required, wallboard $\frac{1}{4}$ inch thick may be bent in the crosswise plane so as to give it a radius of 15 inches. For slight curves, the more substantial "Plyform" of greater thickness is suitable because a $\frac{5}{8}$-inch panel can be given a 10-foot radius longitudinally or an 8-foot radius transversely. At the present time, one of the two big outlets for fir plywood is the making of concrete forms. The other is the building industry—the construction of homes, industrial and commercial structures, and permanent as well as temporary camp and other buildings for the army and navy in the program of national defense.

This is a day of refinement in products and processes—strength without excess weight, streamlined smooth surfaces as against angles and roughness. These conditions have been met by Douglas fir plywood, which is to ordinary lumber what alloy steels are to plow steel. It is an achievement in wood that, in addition to the qualities already mentioned, is characterized by durability, workability, resistance to warping, and beauty.

It may be a sign of weakness or sentimentality that we hate to see these magnificent trees brought to earth by the fallers' saws. But for the most part they are where few eyes can see them; and, like all living things, they grow, mature, and die if left alone. Since they must inevitably come down, to shorten their existence is, perhaps, not so terrible after all. Anyway, to be carefully unwound and turned into remarkably pleasing and utilitarian products should be less trying to a fine Douglas fir than to have its "innards" spilled by a band saw and be turned into two by fours and roof boards.



Brown Bros. Photo

SPINDLETOP GUSHER

A picture of the discovery well, drilled by Capt. A.F. Lucas, taken four days after it came in on January 10, 1901, with a flow estimated at 20,000 barrels a day. Spindletop, near Beaumont, was the first large oil field in Texas. It was the birthplace of The Texas Company, now The Texas Corporation.

A Couple of Small-Town Boys

C. H. Vivian

IN THESE days when entire mining plants are flown into remote sections, the shipment of a 12-ton air compressor from New York to Texas by express sixteen years ago may not be classed as a breath-taking transportation event. Nevertheless, it was considered a bold exploit in 1924, and even now it makes a story worth the telling. It is a tale of numerous parts; and, in knitting them together, the account will be a rambling one.

The locale is the Powell oil field in east-central Texas and about 9 miles from the City of Corsicana. It was in the latter place that the Texas oil industry had its real beginning, although there was some previous production in nearby Nacogdoches County as early as 1866, and again twenty years later. Needing more water, Corsicana contracted in 1894 with the American Well & Prospecting Company to drill three wells. The first of these struck oil at a depth of 1,027 feet on June 9. The oil was considered a nuisance, and was cased off; but it continued to rise to the surface outside the casing. The well was deepened to 2,470 feet, where warm water under pressure was tapped.

In those days petroleum was not the vital commodity that it is now. Nevertheless, some of the citizens of Corsicana thought there might be profits in oil wells, and they organized the Corsicana Oil Development Company. It completed a producing well on October 15, 1895; drilled four more in 1896; and by the end of 1897 had 47 producers. The output in that year was 65,975 barrels. There was a flurry of excitement and considerable activity. Derricks were put up almost on the edge of the area that was later to become Powell Field, and hundreds of people walked over it; but the discovery of oil there was to be deferred for nearly 30 years.

There was a very limited demand for Corsicana petroleum, because the only known uses for it at that time were as fuel for drilling additional wells and for making gas in cities such as Austin and Dallas. It was realized that a refinery was needed, and Mayor J. E. Whitsell interested J. S. Cullinan, a Pennsylvania refiner, in the project. The latter obtained financial backing and, with Walter B. Sharp, built a refinery in Corsicana under the name of the J. S. Cullinan Company. This concern was the predecessor of the Magnolia Petroleum Company, now a prominent subsidiary of the Socony-Vacuum Oil Company, Inc. In their efforts to create markets for the oil and its derivatives, Cullinan and his brother persuaded the Cotton Belt Railroad to allow them to install oil-burning equipment in a locomotive pulling passenger trains between Corsicana and Hillsboro. Cullinan also introduced the practice of using oil for consolidating street and road surfaces, having noticed that the oil-soaked sand around oil tanks packed down well and did not blow away.

Cullinan and Sharp gained experience at Corsicana that helped to develop the Spindletop Field near Beaumont—the first great gusher oil field in Texas. Sharp drilled the pioneer well in that area; but the first producer was brought in by Capt. A. F. Lucas in 1901. Cullinan and Sharp were active there; and, with the financial backing of John W. ("Bet a Million") Gates, launched The Texas Company, which, under its present name of The Texas Corporation, is one of the nation's largest oil concerns.

One of the men to gravitate to Spindletop was William S. Farish, who left a law office in Mississippi to work in the new field. He made friends with Robert L. Blaffer, a clerk in the office of the Southern Pacific Railroad, and the two started buying and selling leases. As additional fields were opened up they became interested in them, and in a few years were successful producers. In the meantime the Humble Field had come in, and R. S. Sterling, who ran a feed store nearby, began loaning money on oil leases and property there. Before long he acquired a lot of land on unpaid loans. With a view to exploiting its oil possibilities, he joined his brother Frank and Walter Fondren, an oil-well driller, in forming the Humble Oil Company. Farish and Blaffer started to buy stock in the company; and the five men later pooled their interests with several others and formed the Humble Oil & Refining Company.

It was the Humble company, with Farish as its guiding spirit, which made possible the development of the Powell Field. Immediate credit for its discovery, however, goes to Col. E. H. Humphreys, a Denver oil man, and his geologist, F. Julius Fohs. The latter, who is still an active consulting geologist with offices in New York, worked out the geology of the Balcones Fault, a great breach in the earth's crust that extends from Austin to

Texarkana, a distance of several hundred miles. The orthodox, textbook type of oil structure is a dome; but perfect domes are not numerous, and much of the world's petroleum comes from variations of them discovered through painstaking geological exploration. Along the Balcones Fault there is a vertical displacement of the rock formations amounting to several hundred feet. This naturally breaks the continuity of the strata. It was Fohs's theory that there were locations where dipping porous sedimentary rocks, with all the attributes of oil reservoirs, were blanked off by this fault, thereby becoming effectual traps.

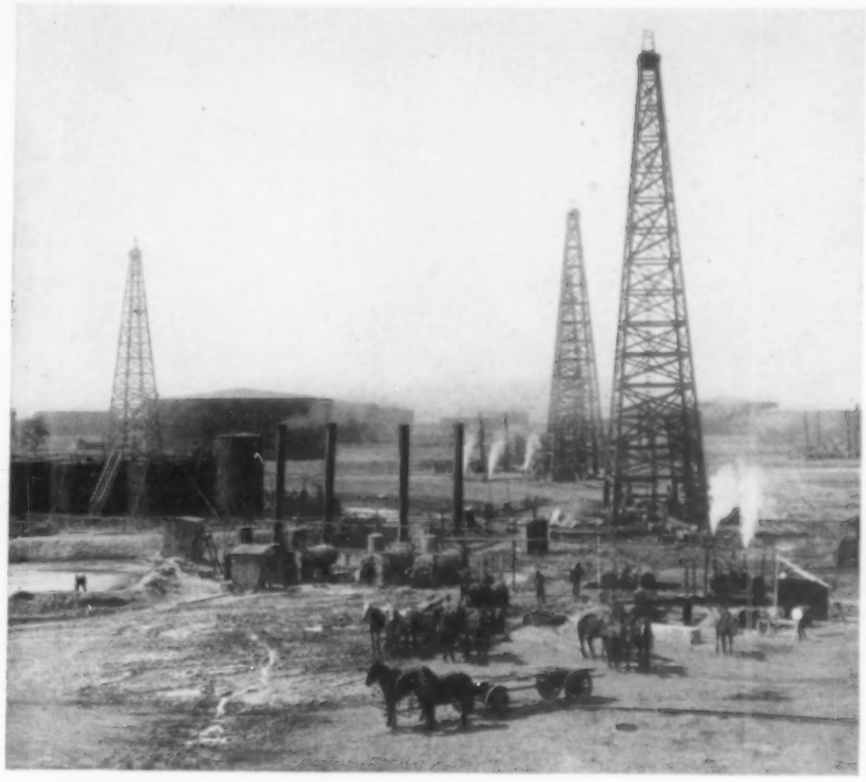
In 1920, the Mexia Oil & Gas Company began to drill a test well on the L. W. Rogers farm near the Town of Mexia, which is a short distance south of Corsicana. The site was apparently chosen by chance, without the benefit of geological knowledge. The well had been put down 1,800 feet when Fohs prevailed upon Colonel Humphreys to buy it. The well was deepened to 3,100 feet and struck a small quantity of oil. It did not flow by itself, but had to be pumped. Humphreys's next well came in as a 4,000-barrel gusher in the summer of 1921, and started the Mexia oil boom. The Mexia Field ushered in a new type of geological structure, the fault-line field, and started a feverish search for similar fields along the Balcones Fault. This resulted in the discovery of the Currie Field by the Humphreys-Mexia Company on November 14, 1921; the Powell Field by the Corsicana Deep Well Company on January 10, 1923; the Richland Field in 1924; and the Wortham Field in the same year.

Upon the discovery of the Powell Field, the major oil companies became active in acquiring leases and acreage. The leader among them was the Humble Oil & Refining Company, which had meanwhile come under the control of Standard Oil Company (New Jersey) in consequence of the meeting of Farish and Walter C. Teagle, head of the Standard Company, as fellow members of the National Petroleum War Service Commission during the World War. Following the war, when Humble was branching out, Farish went to New York in quest of additional capital. He called on Teagle, and the outcome was that Standard of New Jersey paid $17,000,000 for a half interest in Humble, which was later increased to 60 per cent. Thus, at the time the Powell Field was discovered, Humble was not only powerful in its own right but also had the backing of the nation's largest oil concern. Farish personally went to the field to obtain leases. With him was Humble's chief geologist, Wallace E. Pratt, who shared with Julius Fohs the belief that structural conditions along the Balcones Fault were favorable to large accumulations of oil.

It is recounted that Farish and Pratt sat at a table in a restaurant in Corsicana on a Sunday afternoon while a line of farmers and other land owners filed past. Pratt had a geological map of the field in front of him, and as each man gave the location of his land and stated his price for a lease on it, the geologist advised Farish whether or not to take it. It is said that Farish wrote $2,000,000 worth of checks that afternoon. Subsequently, Humble produced approximately 30 per cent of the petroleum that came from the Powell Field. Farish's courage and Pratt's judgment were thus fully justified, and both men were brought more closely to the attention of Humble's parent company. Farish ultimately became president and Pratt vice-president of Standard of New Jersey, and they hold these respective positions today. It is also of interest to note, in passing, that Robert L. Blaffer, who left a railroad office to form a partnership with Farish in the early days of the Spindletop Field, became president of the Humble Oil & Refining Company and is now chairman of its board of directors. In this manner do the shifting sands of time affect the destinies of men.

We have reached a point in this meandering chronicle when we must find our way back to the original subject of compressors, and, in so doing, will introduce the principal characters of our story. They are H.R. and W.C. Stroube of Corsicana, brothers and members of the oil-producing firm of Stroube & Stroube. This pair arrived at Powell Field from Oklahoma in May, 1923, before the real extent of the field was known and when there was relatively little excitement. Raised in a western Oklahoma town, they had decided to become oil-well drillers and had bought a rig. They drilled one 300-barrel well on contract, but made little money. Another job didn't turn up right away, and they were on the point of disbanding their crew when a banker named Roberts, from Terrell, Tex., approached them with a proposition. He owned 7½ acres of land and wanted a 3,000-foot test well put down. He was unwilling to pay for it, but offered the Stroubes a lease on 2½ acres in return for drilling it.

The brothers did not have sufficient money to pay the crew regular wages, so the latter agreed to work for $5 a day, with a promise of $10 a day additional if the well struck oil. The land was almost on the Balcones Fault; and the site for the well was picked by means of a map. When the time came to put up the derrick, it was found that the spot selected was on top of a tank dike that had been thrown up by the Humble Company for a contemplated tank farm. Accordingly, the well was located a few feet outside of this enclosure. Because they were short of money, the



STROUBE LEASE, POWELL FIELD

This picture was taken probably some months after the completion of the initial well described in the accompanying article. The jets of steam near the right-hand edge are coming from a compressor that was used to renew the flow of oil after it had suddenly ceased. A second machine was being erected left of the one in operation.

PANORAMA OF POWELL FIELD WHEN NEARING ITS PEAK PRODUCTION

Stroubes drilled the well as cheaply as possible. They cased the first 200 feet, and from that point downward left the hole unlined. They expected to reach the oil sand, if at all, at 2,750 feet, and when that level was passed without results they felt that there was small chance of success. However, they had contracted to put down a 3,000-foot well, so could not quit.

When oil was struck, H. R. Stroube was running the rig alone. It was lunch time, and he had told the others to go get something to eat. They had been gone only about twenty minutes when the bit began making hole fast, and he knew it was in a sand formation. Actually, it was the Woodbine Sand which has since then been a prolific source of Texas oil. It had been productive previously in Arkansas, but had not yielded oil in Texas until the Powell Field was discovered. The tools were withdrawn, and examination of the bit showed that it had been cutting sand; but the well did not flow. In order to test the well it was necessary to case it. Reluctantly, for they didn't think it worth while, the brothers spent $3,500 for casing and borrowed some old valves and fittings to save money. With the casing in place, the well was swabbed, and immediately began to spout oil. The president of the company, who owned the lease where the pit had necessitated relocation of the Stroube well, walked over, placed an arm around H. R. Stroube's shoulder, and said: "Too bad, my boy, but you've drilled an oil well on our land."

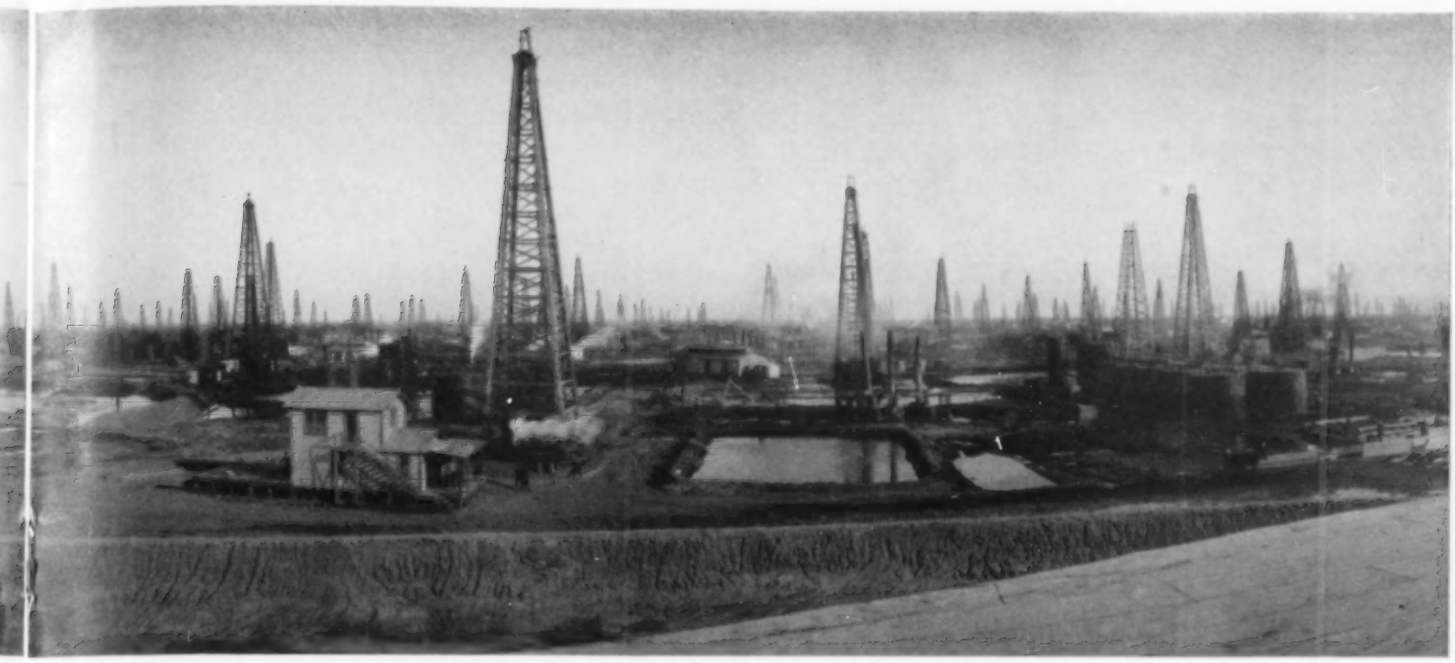
To determine the ownership, sixteen surveys were run. In the end it was found that the valve on the casing head was exactly 16 inches inside the boundary line of the banker's land on which the Stroubes held a lease. Had it not been for the change in location because of the embankment, the well would, indeed, have been on adjoining property. Meanwhile, during the running of the surveys, the well had been flowing wild. Having had little if any expectation of getting a producer, the Stroubes had made no preparations for handling oil. They ran it into the neighboring pit; but that was soon filled up. There were several tank farms nearby with no oil in them, and all were close to the Humble Pipe Line. The Stroubes telephoned the Humble offices in Houston, told them of their plight, and Humble rushed a crew into the field to lay pipe lines from the well to these tanks. Inside of six hours the connections were made. Three hours later, Humble was taking oil into its pipe line at the rate of 10,000 barrels daily. This was all it could handle, for oil was also being taken from other producers. The Stroubes therefore started erecting tanks of their own to provide storage for the surplus until it could be moved out of the field. It was February and cold and wet, and it began to snow. The tank builders did not want to work, and to induce them to do so the brothers paid them as much as $100 a day.

The well had come in with a daily output of 13,000 barrels. On the day the contract to drill it was signed, oil was selling for $1 a barrel. The price went to $1.50 the day the well was spudded in; to $2 on the day the casing was set; and it was $2.25 on the day the well came in. In 33 days it yielded 335,000 barrels worth $753,750, and then suddenly stopped producing.

The Stroubes knew that they could renew the flow with an air lift, and they set about to obtain an air compressor. None was available in the field, so they telephoned the National Supply Company, in Houston, which was at that time agent for Ingersoll-Rand Company. The Stroubes were informed that there was no compressor in stock and that it would take about ten days to get one from the factory. "How long by express?" they queried. "Three days," was the reply after the matter had been looked into. "Express it," was the command.

Telegraphic instructions to this effect were sent to the Ingersoll-Rand factory at Painted Post, N.Y., being relayed through the company's main office in New York City. The order caused considerable consternation in both places, for no one had ever before asked for a large compressor by express. Thinking that there must be a mistake, New York telephoned Houston for verification and also to ask if the customers were of sound mind. Immediately forthcoming was the assurance that the order was *bona fide* and that the Stroube Brothers were not only sound-minded but keen-minded.

At the Painted Post factory the order occasioned difficulties. There was no express car large enough to accommodate the machine, and one had to be procured from New York. The records at Painted Post show that the compressor was partly dismantled and shipped in four boxes. One of these contained the frame and running gear and weighed 17,430 pounds. The contents and weights of the others were: flywheel, 3,370 pounds; intercooler, 2,200 pounds; governor, lubricator, piping, and wrenches, 685 pounds. The total weight was 23,685 pounds. Shipment was made on April 10, 1924. The express



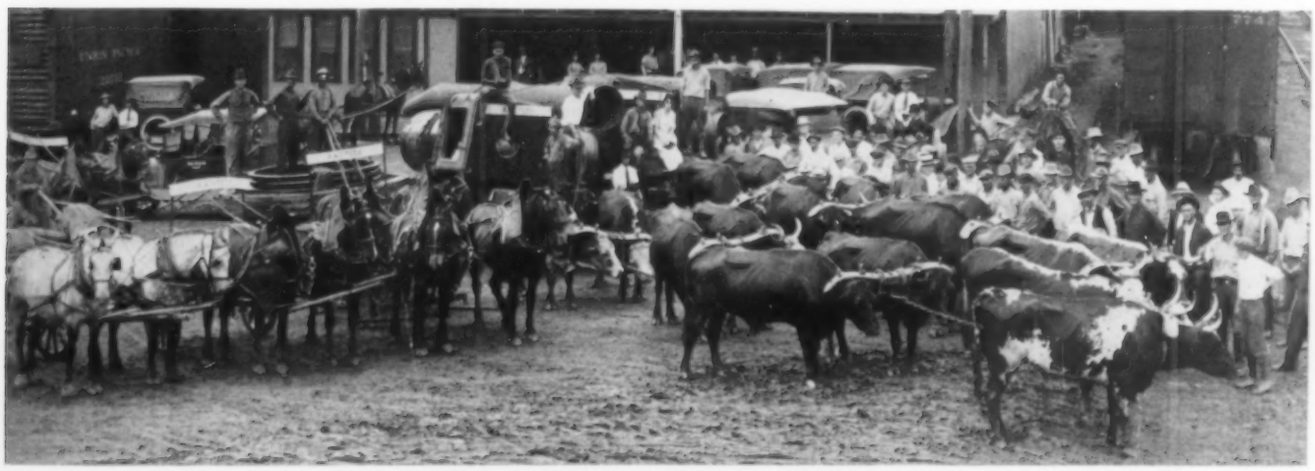
charges were $1,900. The compressor was a steam-driven Type X-2 unit with 12x16-inch steam cylinders and 15&6¾x16-inch air cylinders. Its piston displacement was 486 cfm., and it was designed for a normal, running discharge pressure of 350 pounds and a maximum starting pressure of 450 pounds.

As soon as they had placed the order, the Stroubes began erecting a boiler plant and foundation for the machine. It arrived in Corsicana three days later and was hauled through the mud to the field by eighteen mules. On the fourth day the machine was working. It "kicked off" the well almost immediately, and during the next 24 hours produced 5,000 barrels of oil worth $11,250. The express charges on the shipment were paid for in four hours.

Soon after the first well came in, the Stroubes started another one, and they eventually drilled the entire tract of 7½ acres which the owner allotted to them 2½ acres at a time. Some of the later wells duplicated the behavior of the first one by suddenly stopping to flow, and a second compressor was obtained by express. Two additional units were purchased; but they were delivered by freight. The four machines were operated some four years and were then sold for a similar service in Arkansas. H. R. Stroube recalls that they brought 60 per cent of their original cost price after having helped to produce hundreds of thousands of barrels of oil.

All told, the Stroubes drilled six wells on their 7½-acre lease. One of them has been abandoned, but the five others are still being pumped and yield about 90 barrels of oil a day. These five wells are among 50 producers that remain in the Powell Field out of the more than 600 that were drilled there.

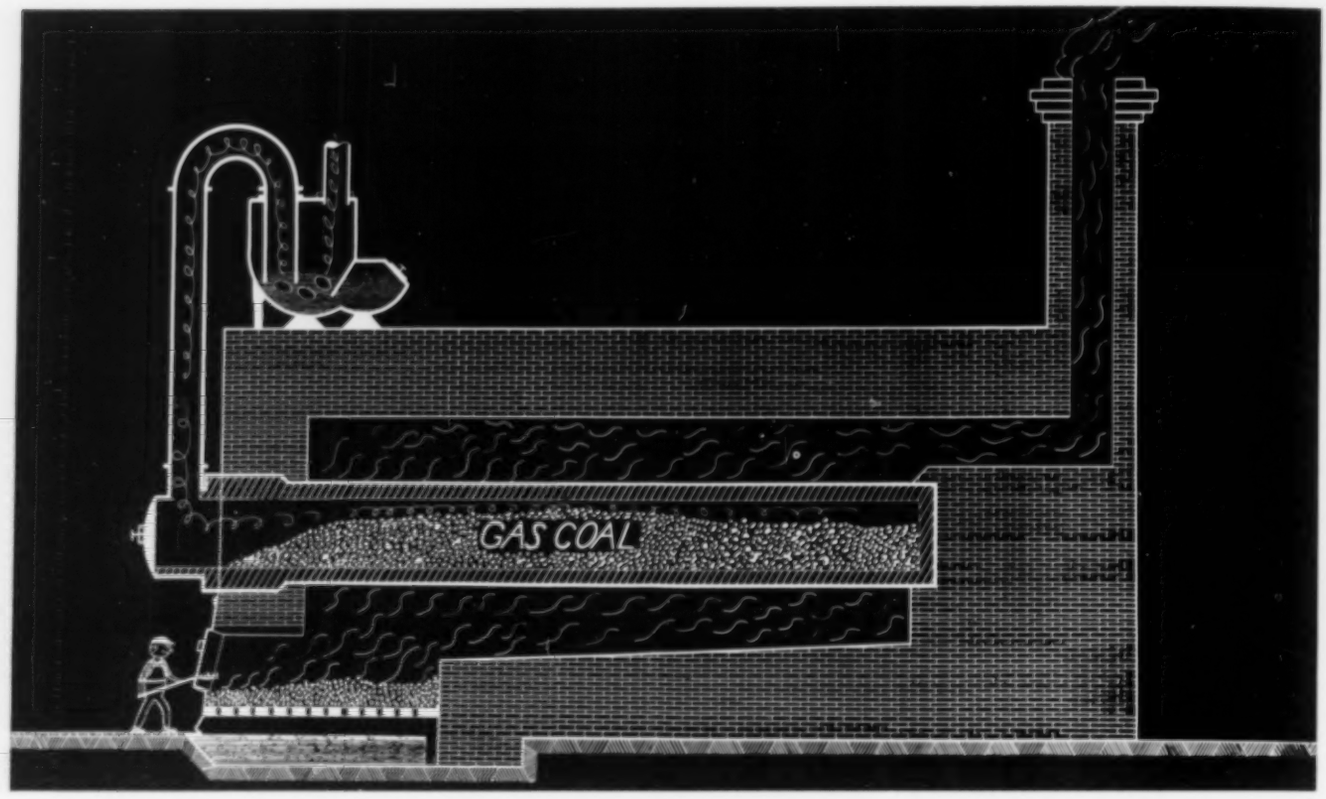
During the intervening years, the Stroube Brothers have branched out into other oil fields and have continued their initial success. From their offices in a Corsicana bank building, they can look toward the Powell Field, and on a clear day see derricks on the horizon. H. R. Stroube gazed in that direction every now and then as he told his story, which he did reluctantly because he said "It sounds too much like Hollywood." He attributed the sudden wealth to luck. "We were just a couple of small-town boys," he insisted, "and the money was dumped in our laps."



Brown Bros. Photo

HAULING SUPPLIES IN THE EARLY DAYS

A view in Ranger, Tex., showing horse and ox teams preparing to leave for an oil lease with heavy equipment just unloaded from railroad cars. As many as sixteen oxen were required to transport one steam boiler. Haulage was a very serious problem before heavy-duty motor trucks were available.



MAKING COKE

Pictorial Story of Gas-Making

Making Coke

COKE-making is the first step in the production of some artificial gas. Bituminous coal is placed in a closed retort or chamber built of silica or a fine clay material and previously heated to a high temperature (in some cases up to 2,400°F.). When subjected to continuous heat the coal fuses and gives off its volatile matter, which builds up pressure and is thus forced through a water seal into a hydraulic main. From there it is pumped through condensing, cleaning, and purifying apparatus and is metered. The resultant gas has a high heat content and is usable without enrichment. By today's standards it is really a by-product of the more valuable coke that is left in the retort after all the gas has been driven off from the coal. The extent to which gas is made by this process is determined by the need for coke. Most household and general industrial gas now distributed is made by some form of the Lowe water-gas process that was introduced in 1875.

Making Water Gas

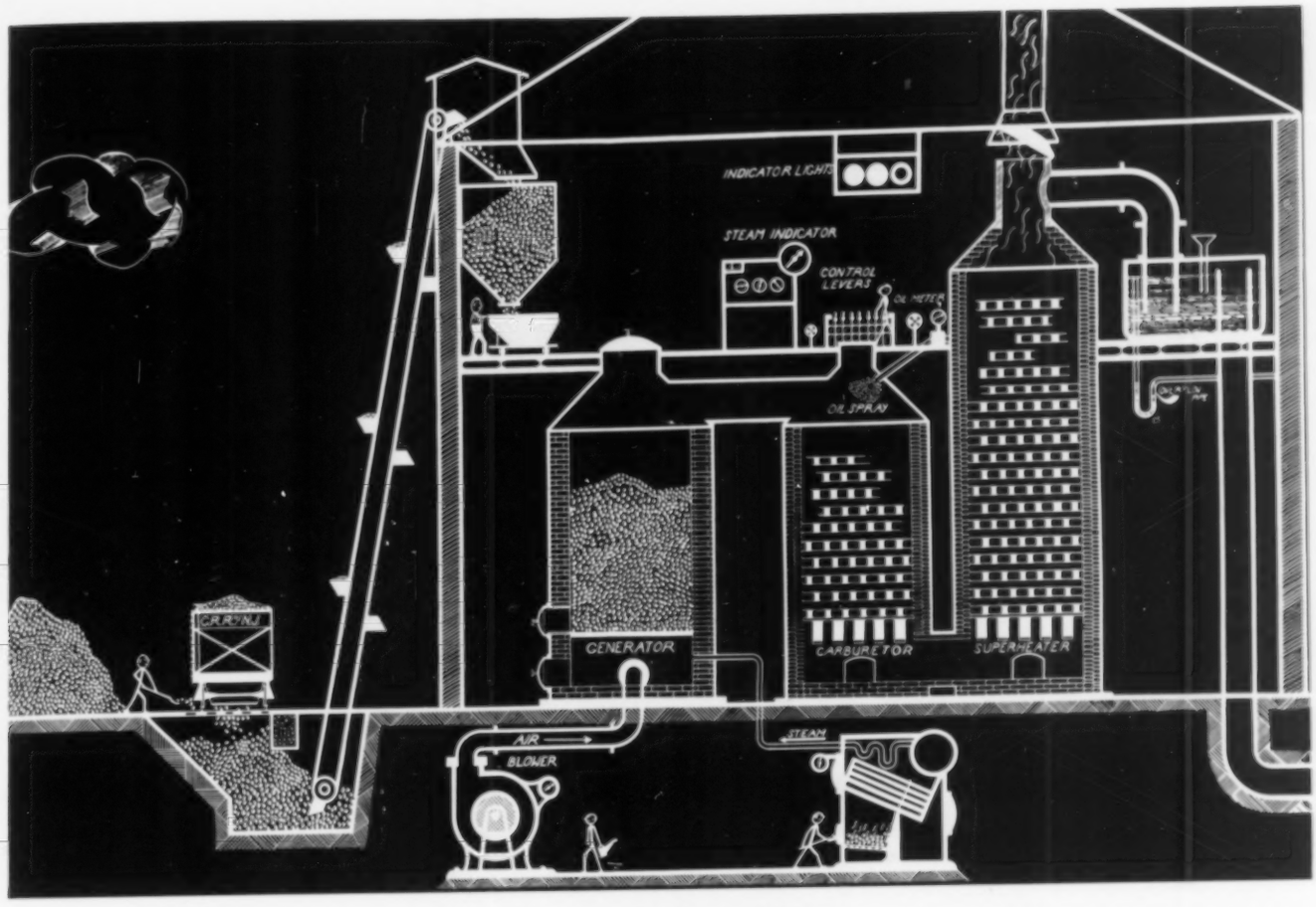
FOR this purpose it is necessary to use a solid fuel having a high carbon content. This may be either coke, anthracite, or bituminous coal. It is placed in a water-gas generator, and in from 1½ to 2 minutes, depending upon conditions, is brought to a state of high incandescence (around 2,400°F.) with blower air. During this blasting period is made a small amount of what is called producer gas. This is ignited upon entering the carburetor by additional air admitted by way of the top of that chamber, and as it burns in its passage through the latter and the superheater it heats the checkered brickwork in both of them. The exhaust is carried off by a valve in the top of the superheater.

After the desired temperature has been attained, the air valves and stack valves are closed and steam from a boiler is admitted at the bottom of the generator, forcing its way up through the fire bed. The steam is decomposed at around 2,000°F. into hydrogen and oxygen, and the oxygen combines with the carbon in the fuel to form carbon dioxide. As this passes on, some of it picks up another molecule of carbon, forming carbon monoxide. The resultant mixture of hydrogen, carbon monoxide, and carbon dioxide has a heat value of about 300 Btu's and must be enriched for commercial use. This is accomplished by spraying oil on the hot checkered brick in the carburetor and causing it to gasify. Enough oil is used to bring the heat value of the combined gases up to approximately 550 Btu's. The stream is directed down through the carburetor and up through the superheater to stabilize the gas derived from the oil. As it leaves the superheater, the carbureted gas forces its way through a wash box, where uncombined tars and light oils are trapped out.

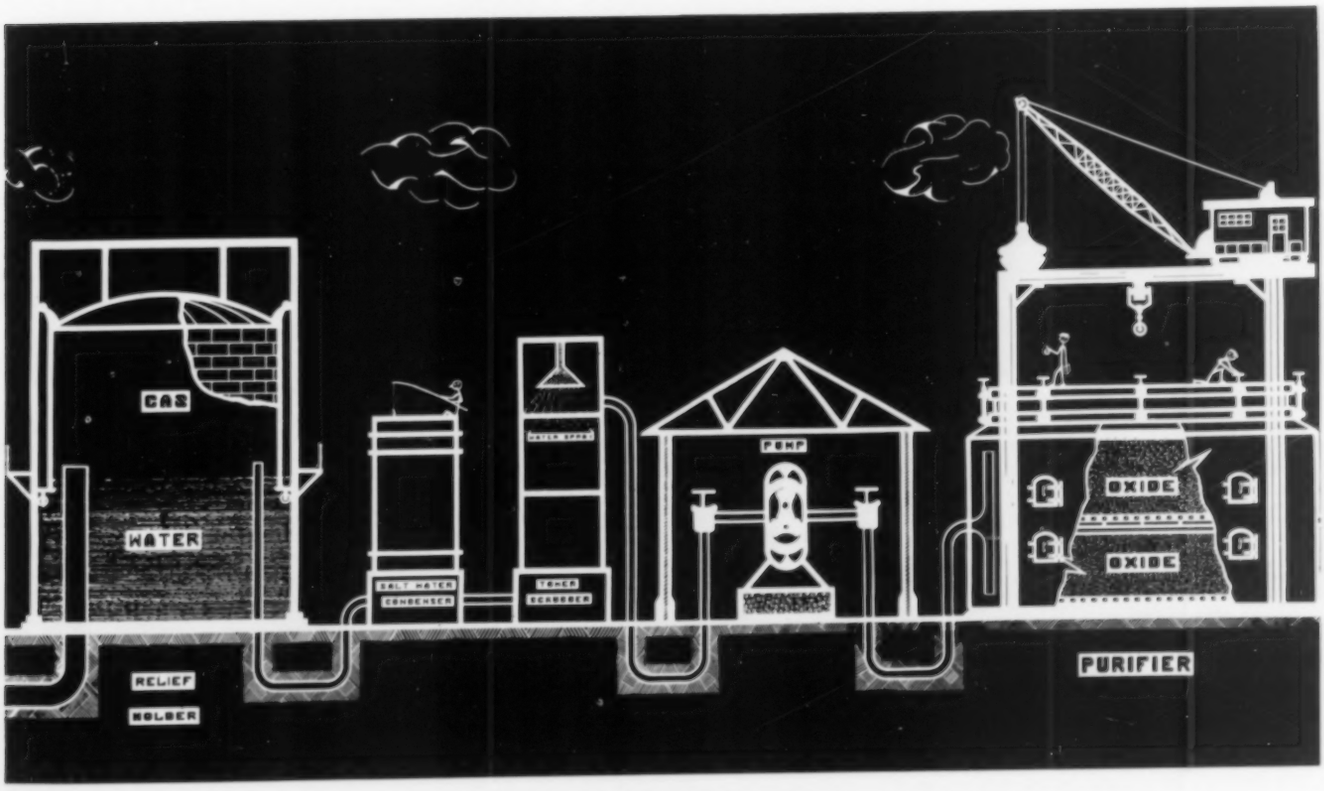
The illustrations are reproduced through the courtesy of J. J. Crilly, Elizabethtown Consolidated Gas Company, Elizabeth, N. J.

Purification

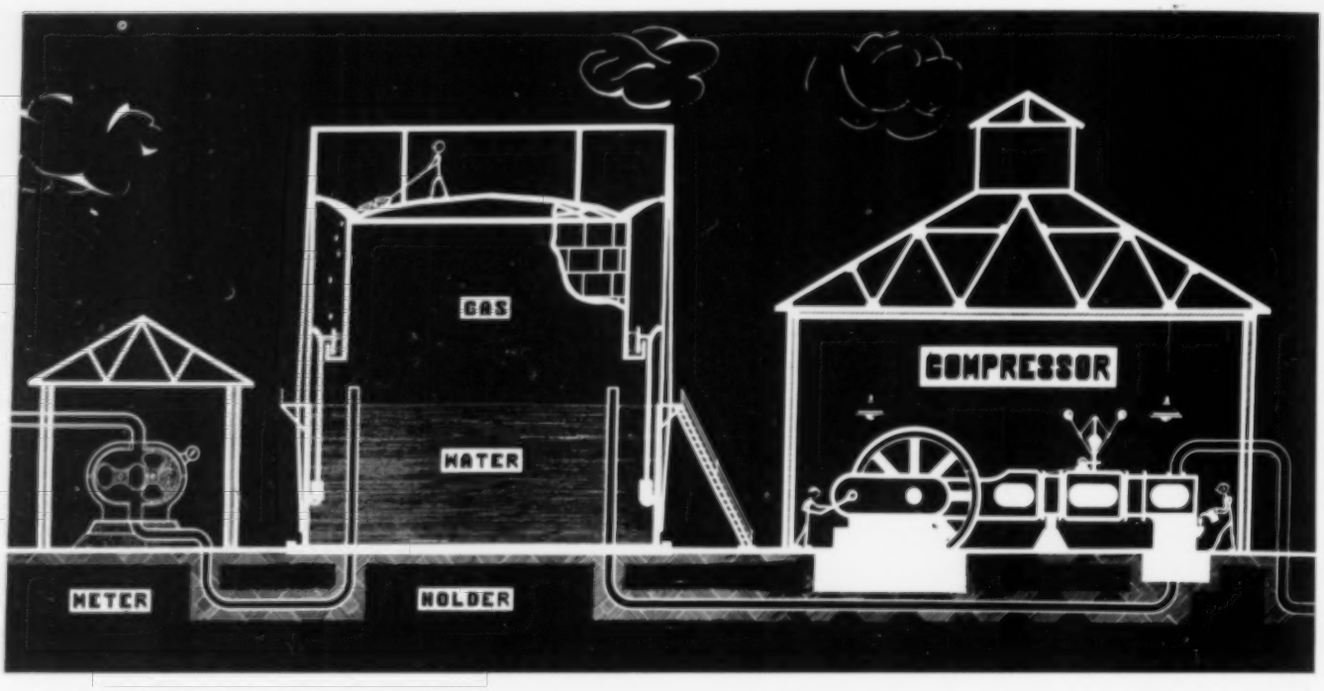
AS it is produced, the gas is discharged into a relief holder. This is necessary because the operation of a water-gas machine is intermittent. From that point on the gas is handled at a steady rate. It is drawn from the holder with a gas-type exhauster pump. It first passes through condensers using either salt or fresh water, according to plant conditions, and is cooled to around 100°F. Next it goes through a tower scrubber, where a water spray washes out any remaining tar and light oils. After that it enters the exhauster, where it is placed under sufficient pressure to force it through iron-oxide purifiers which extract hydrogen sulphide.



MAKING WATER GAS



PURIFICATION



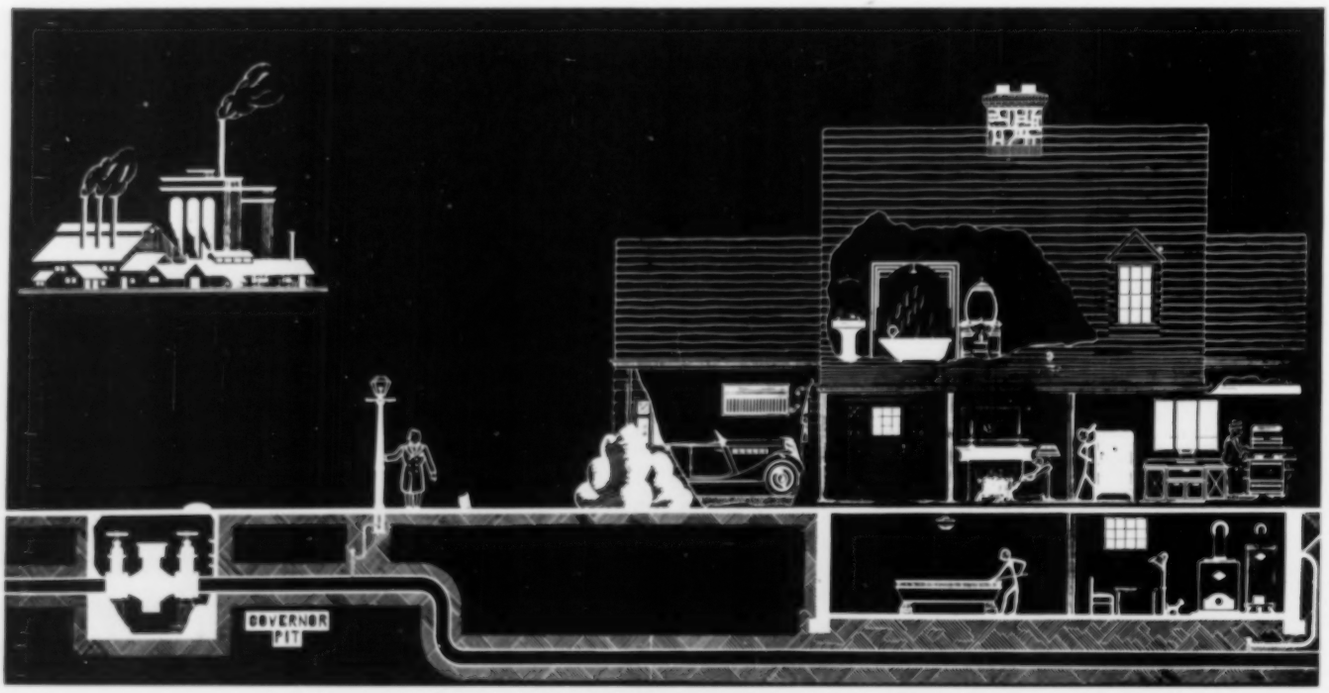
METERING, STORING, AND DISTRIBUTING

Metering, Storing, and Distributing

THE purified gas is metered and run into a telescoping-type storage holder, where it is held for distribution. The figure shown on the holder is shoveling off snow which, in winter, sometimes accumulates in drifts on one side and leads to an uneven distribution of weight. In latitudes where subfreezing temperatures are experienced, steam is used during cold snaps to heat and circulate the water in the cups or troughs that seal the joints of the holder sections. Where the gas must be sent through long lines, compressors or blowers are employed to raise its pressure, as required. A reciprocating compressor is illustrated here.

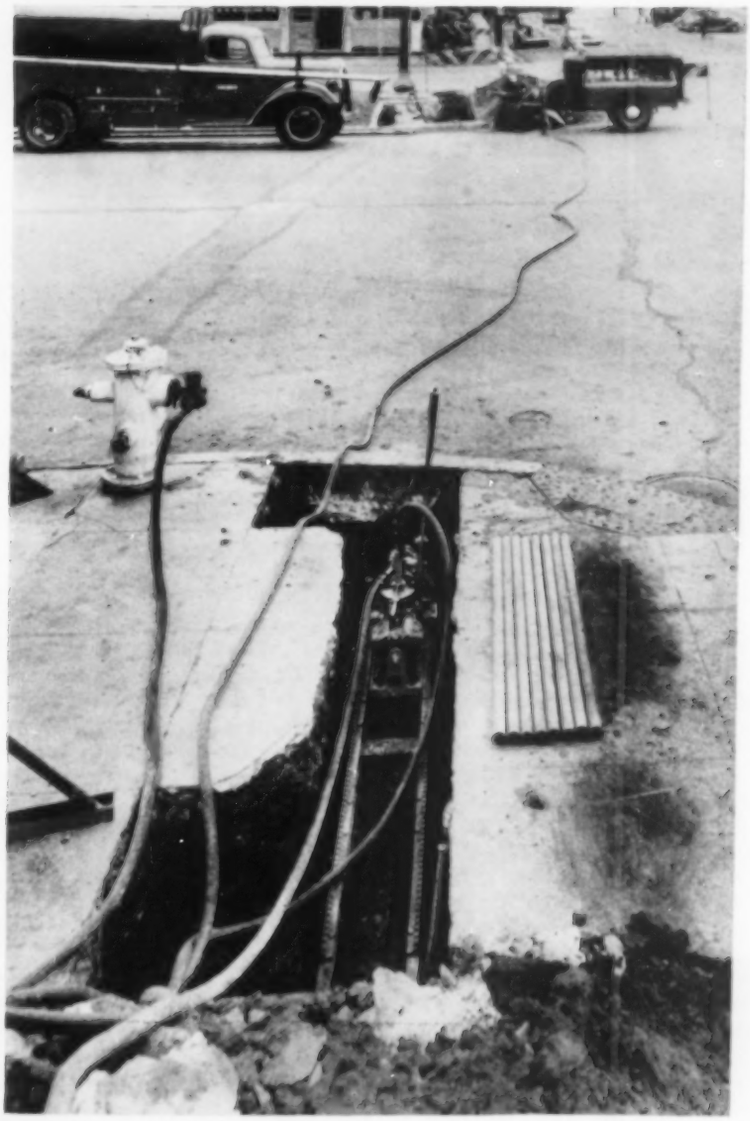
Utilization

BEFORE it is used on the consumer's premises, the gas must be reduced in pressure, and this is done by means of a governor. Today's demands range all the way from gas for the tiny pilot flame of the household range to the tremendous load imposed by industrial furnaces. Many of our comforts of living are attributable to gas, the application of which has been revolutionized during the past ten or fifteen years. Its uses in the home, some of which are illustrated here, include house heating, water heating, cooking, and refrigeration. Modern gas appliances are automatically controlled and require a negligible amount of attention.



UTILIZATION

Unusual Job of Slide Prevention



NO TRAFFIC INTERRUPTION

At the right is a heavy-duty Hydrauger boring an 8½-inch hole beneath a 60-foot-wide street in Petaluma, Calif., for a 6-inch gas main. The set-up is a typical one, and shows the machine hooked up with a portable compressor and a water plug. A number of hollow boring bars are at the right of the excavation, which is 8 feet long. The Hydrauger is anchored at a level 10 inches below the center line of the bore hole and is operated by means of a Type AA reversible air motor with air at 90 pounds pressure.

AN UNUSUAL SET-UP

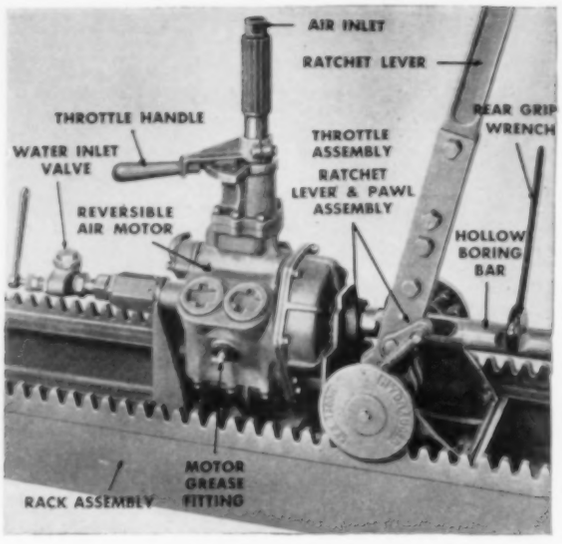
Below we see a Hydrauger of the heavy-duty type engaged in slide-prevention work along a stretch of highway in Sonoma County, Calif. The unit bored a number of horizontal holes, 6 inches in diameter, in the unstable embankment. These had an aggregate length of 791 feet, and all but 74 feet was lined with 4-inch casing. They tapped vertical holes, 30 inches in diameter, and served to carry off the troublesome water. One of these drain pipes is shown at the bottom discharging at the rate of approximately 100 gpm.

IN THE last biennial report of the California Division of Highways are some interesting facts about slide and slipout prevention work done by the department in sections where heavy excavating and embankments were required to give roads the desired grade and alignment. This work comes under the head of maintenance, and presents a greater problem today than it did in the past when highways followed contours and beaten paths. The accepted practice in that state is to trim cut banks to their ultimate slope at the time of construction and to let the maintenance forces take care of slides and subsidence. It is therefore necessary for the latter to anticipate slides whenever possible and to remove overhanging material.

Slide allotments for the past six years, according to the report, have amounted to more than $9,800,000, and as much as $80,000 has been spent on a single 300-foot stretch to restore a road to service after a slipout. In a case of this kind the usual procedure is to remove the unstable material, which may reach a depth of as much as 30 feet below the surface. However, this is resorted to only where other methods such as drainage are not feasible.

Where impending slide or slipout conditions are attributable to saturation either of an earth slope above a road or of a fill or foundation, the underground water may be collected in trenches backfilled with porous material to permit the water to seep to outlets, or it may be carried off by means of perforated metal pipe or tile underdrains installed so as to intercept the water. Occasionally, however, these measures are ineffective; and during the past year the Division of Highways has experimented with a new one. It consists in drilling horizontal holes and in placing in them perforated pipes with which to tap the subterranean water impounded in deep cut banks or sidehills and to relieve the hydrostatic pressure.

This procedure was first tried along a stretch of road where there was every evidence of both slippage and hydrostatic pressure. In the cut slope, at a point 300 feet above the highway, were cracks, the road surface bulged, and there was moisture at the toe of the slope. Borings served to locate the slippage plane and to determine the water level, after which four vertical holes, 30 inches in diameter, were



POWER UNIT

In operation, the air motor with its integral parts travels along the rigidly anchored rack assembly, as illustrated at the right, and controls the forward and backward movement of the bit with its boring bar made up of sections 4 feet 8 inches long. The compact little unit can be readily dismounted, as shown in the picture above which was taken in the course of the slide-prevention work done by the California Division of Highways.

drilled in the affected area. Water was encountered during drilling and gradually rose until it reached a height of approximately 25 feet in the holes. To drain it, four horizontal 6-inch holes were bored in the bank to intercept the vertical holes, and a few more were driven in the same plane but at staggered points. The smaller holes were lined with 4-inch pipe that had perforations in the top side only so as to prevent leakage and loss of discharge water. An aggregate of 717 feet of casing was required, and each drain delivered a sizable stream of water for several days, after which the flow slackened. The vertical holes dried up immediately after they were tapped by the horizontal holes. In this way the hydrostatic pressure was eliminated, the lubrication on the slippage plane was reduced, and the cut stabilized.

The 6-inch holes were drilled with a Model 2A-2X or heavy-duty Hydrauger, an earth-boring machine of the auger type operated by an Ingersoll-Rand Type AA reversible air motor and using, in this instance, an I-R Size 3B air-driven, direct-acting pump furnishing water at 150 pounds pressure to cool the bit and to remove cuttings. Ordinarily, circulating water is taken from a hydrant or other available source. The holes were started with a 2-inch pilot drill followed by a 6-inch reamer. Approximately 840 feet of 2-inch hole was bored, and of this footage 791 feet was reamed to the desired size. A second installation of horizontal drains was made in the same way in Solano County.

The Hydrauger was introduced about ten years ago, and was described in the March, 1931, issue of this Magazine. There are two models—the heavy-duty and the featherweight—and they are generally used by gas, water, electric, and telephone companies in running pipes under sidewalks, streets, railroad crossings, lawns, etc., where open trenches would interfere with traffic and necessitate repaving or resodding. They are designed to bore horizontal holes from 2½ to 14½ inches in diameter for distances up to 120 feet through any underground formation from sand to rock (not concrete), the speed of advance depending on the material penetrated. For example, an 8½-inch hole in ordinary soil may be drilled at the rate of 1 foot in 1.5 minutes; in heavy clay in from two to three minutes; and it may take fifteen minutes to bore a hole of the same diameter a distance of 1 foot in solid limestone. To guard against misalignment, the machine is provided with a front and a rear sight. These are set up after it has been lowered in the ditch prepared for it and are trained on a target placed in another excavation at the point where the pipe is to emerge. When properly lined up, the Hydrauger is anchored with stakes, one at each corner; the sights are dismounted; and the work of boring can begin.

Clearing a Path Through Fog Over Airports

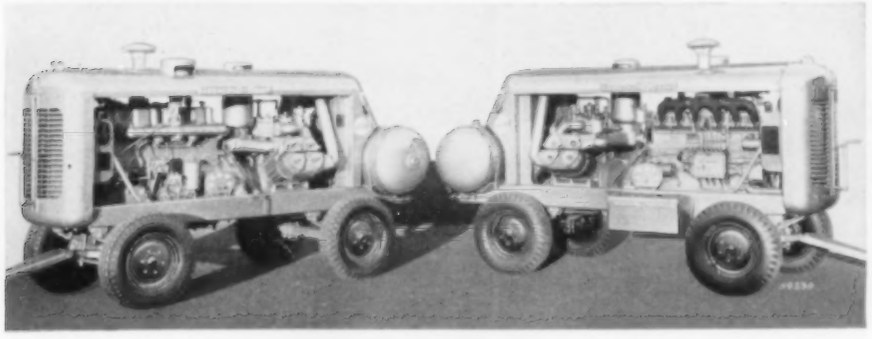
PILOTS of ships as well as of airplanes dread fog, and with reason, because it destroys visibility. The menace, however, is even greater in the case of the flying machine because it has to keep going or make a landing if the fuel supply runs low. For some years scientists have been engaged with the problem of clearing the atmosphere over airports in times of thick weather so that aviators can bring their planes safely to earth. This sounds fantastic; but we have it on good authority that it is feasible.

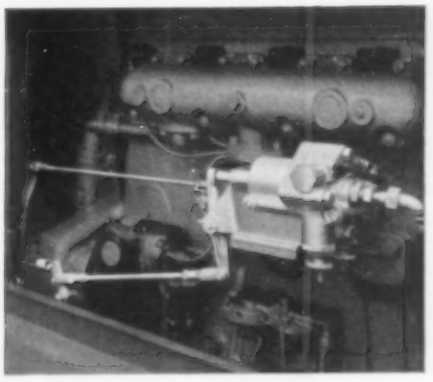
The method that promises to remove the obscuring blanket was developed at the Massachusetts Institute of Technology. The investigations were conducted by Doctors H. G. Houghton and W. H. Radford, members of its staff, in coöperation with the air corps of the United States Army and Navy, and were on a sufficiently large scale to determine what the system could be counted on to do. It is based on the use of chemicals sprayed over the desired area by apparatus in flying machines, just as large tracts of cultivated lands are now dusted from aloft to destroy insect pests. Sulphur chloride, which has a natural tendency to absorb water, is the liquid solution used.

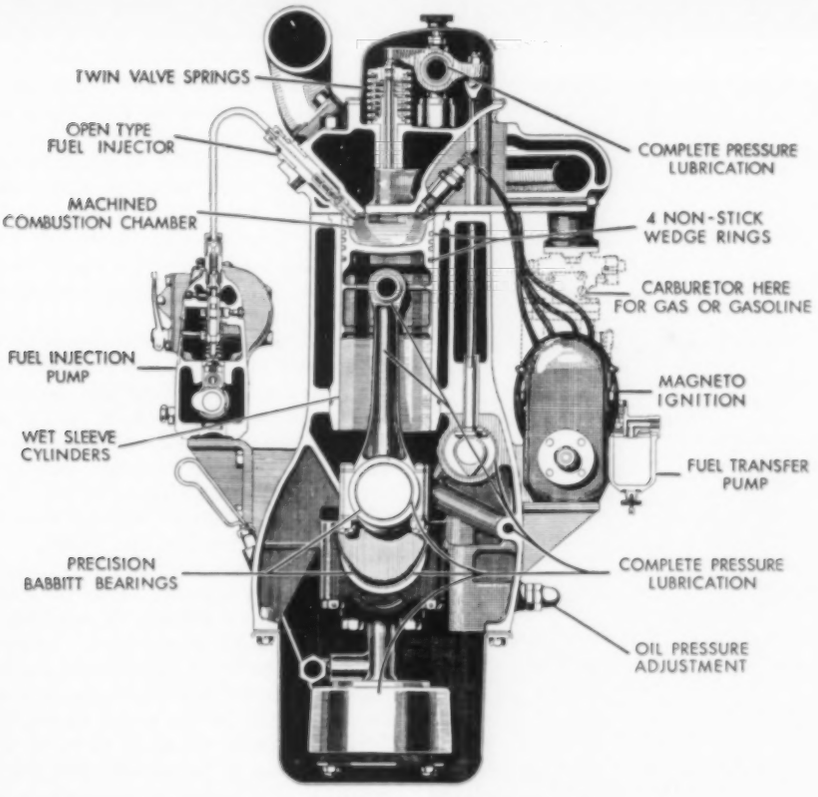
In explaining how the method works, Dr. S. Petterssen, professor of meteorology at the Institute, said: "Fog is nothing more than a collection of minute particles of moisture collected about nuclei consisting of microscopic dust. In pure air fog cannot form. The dust particles are usually salt from the sea or products of combustion from factories or elsewhere. When sulphur chloride is sprayed into a foggy area it collects all the moist particles of fog into drops, which fall to the ground like rain." Heating the air continuously will also cause precipitation; and according to experiments by Dr. David Brunt, professor of meteorology at the Imperial College of Science and Technology, the burning of 7,500 cubic feet of domestic gas will, under certain conditions, dispel fog from an area about 325 feet high and 325 feet square. However, this method has the disadvantage of requiring ground equipment which may prove to be a menace to descending airplanes.

Doctors Houghton and Radford found that a slice 30 feet high, 150 feet wide, and 1,500 feet long could be cut out of the fog in the direction of the prevailing wind by spraying the chemical at the rate of 85 gallons a minute, thus demonstrating the possibility of clearing a space for landing. "It is entirely feasible," said Doctor Petterssen in conclusion, "that, at a not too distant date, pilots coming into an airport where ceiling zero conditions prevail because of fog may see the fog dissolve to reveal the runways."

Portable Compressor with a Three-in-One Engine







CONVERTIBLE

The two Mobil-Air portable compressors at the top are identical in every respect and show the one on the left with the detachable carburetor in place for burning gasoline and the other with the substitute fuel pump and injector nozzles for burning oil. There are five models in this K Series. They range in capacity from 105 to 500 cfm. at 100 pounds pressure (sea level) per square inch and are designed for skid or truck mounting and with steel or pneumatic-tired wheels. Size for size, they weigh up to one-third less than the preceding machines. At the bottom is a longitudinal section of the Multi-Fuel engine, and at the top, right, is a picture of the multi-speed regulator that prevents wasteful idling when the compressor is running.

PORTABLE compressors with engines that can be converted by the user to burn fuel oil, gasoline, or natural gas—in a pinch even bottled gas—have been announced by Ingersoll-Rand Company. They are said to be the first of their kind, and enable contractors to take full advantage of fuel prices in the areas in which they happen to be working. The conversion is effected by simply changing a few fittings. To be specific, if you've been burning gasoline and want to use oil on the next job because it's cheaper, all you have to do is to substitute a fuel pump and injector nozzles for the carburetor and change spark plugs.

With their copper-colored bodies and blue wheels, the new 2-stage, air-cooled machines are distinctive in appearance. They are further distinguished by the trade name Mobil-Air, which will henceforth stand for Ingersoll-Rand portable air power. The engine, which gives them their unusual measure of adaptability, is known as the Multi-Fuel. It was built by the Waukesha Motor Company to Ingersoll-Rand specifications and is a development of the Waukesha-Hesselman low-compression oil engine first constructed for I-R portables ten years ago.

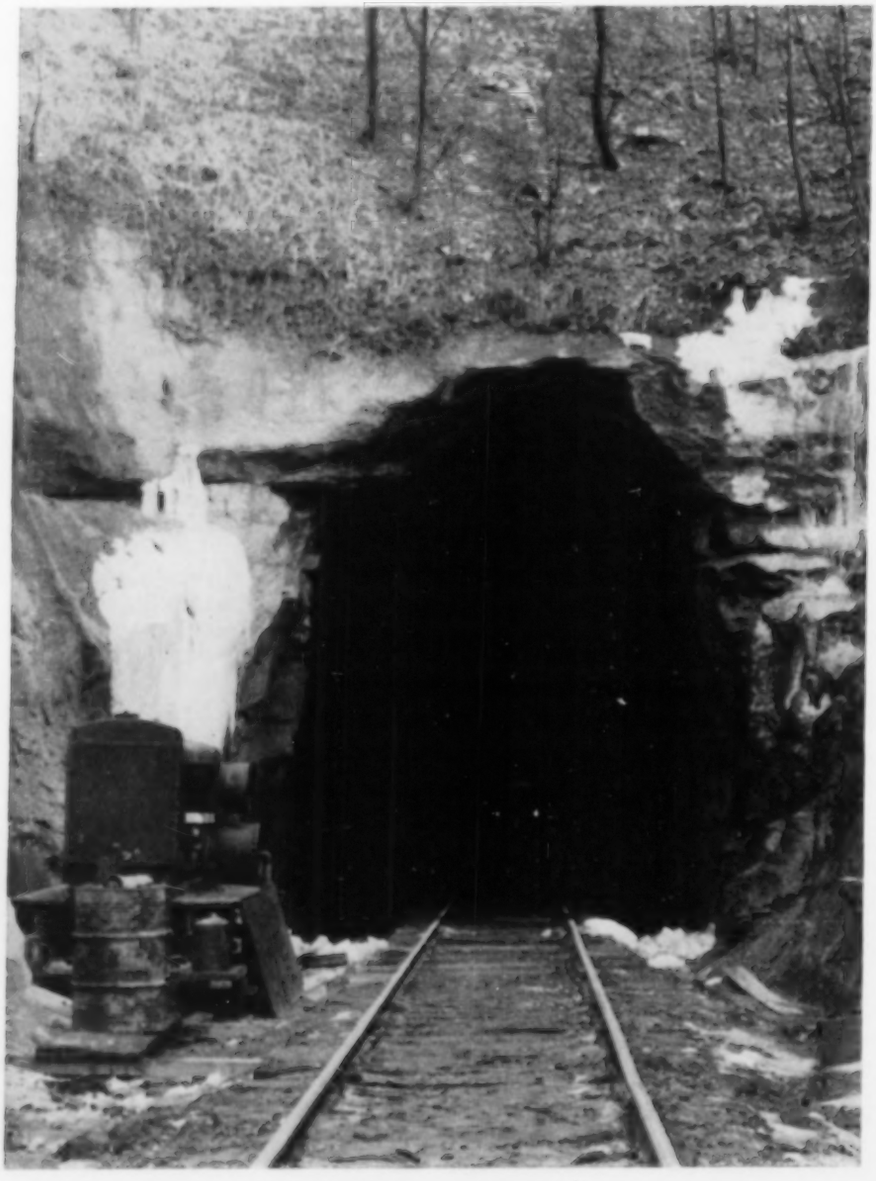
Another Mobil-Air feature is the patented Drill-More speed regulator. This device gives the engine three working speeds—high, intermediate, and low, and automatically adjusts the speed in accordance with the air requirements and with a minimum of idling. As the compressor manufacturer has explained it: "Every time a portable unloads, the gasoline that keeps it idling is wasted. Much of this idling fuel could be saved by hiring an operator to keep his hand on the engine throttle and to slow down the machine each time the air pressure approached the unloading point—that is, to run the compressor only fast enough to maintain the desired pressure. But the man's time would cost more than the fuel saved, and he would probably stall the unit. The Drill-More multi-speed regulator is a built-in robot. When less than half capacity is needed, for example, the machine unloads like other portables, idles for a while, but reloads at low speed instead of accelerating to full speed. Consequently it does not waste gasoline unless more air is delivered at the low speed than is being used."

The foregoing statements are significant in view of the fact that portable compresors operate at less than full capacity most of the time. In competition with older models, and using Jackhamers and paving breakers under actual field conditions, the new machines eliminated up to 90 per cent of the usual number of idling periods and effected savings in gasoline consumption of as much as 40 per cent, depending upon the load. It is further claimed that running at a lower average speed reduces wear and tear on the working parts, while the maintenance of more uniform pressure results in an increase in drilling speed up to 15 per cent.

Enlarging Century-Old Tunnel

A TRANSPORTATION tunnel that is almost 100 years old is being enlarged by the Pennsylvania Railroad. It is the Goston bore 4 miles east of New Lexington, in Ohio. It was driven in 1846 as a part of the Cincinnati, Wilmington & Zanesville Railroad, which afterward became the Cincinnati & Muskingum Valley Railroad and was then absorbed in the Pennsylvania system.

The tunnel extends for a distance of 1,180 feet through a hill composed of sandstone. Mechanical rock drills and dynamite were unknown when it was constructed. Sections of it were hand drilled and blasted with black powder, while others were excavated with picks. It was originally known as the Lionsdale Tunnel, a name suggested by a legend to the effect that lions and tigers inhabited a nearby thicket.



MAKING IT BIGGER

One portal of the Goston Tunnel, and a view inside showing workmen with chipping hammers scaling down the sandstone walls to enlarge the bore.

When coal deposits were opened up between New Lexington and Roseville, and the Hocking Valley Field was developed some time later, hundreds of cars of coal passed through the bore daily en route to Zanesville for transfer to boats moving up and down the Muskingum River. Subsequently, more direct railroad lines began to handle much of the traffic.

The tunnel is celebrated locally because it served as a stepping stone for one of Perry County's citizens in reaching an office of national importance. Jeremiah M. Rusk, who drove a stagecoach between Zanesville and Newark, gave up that work to become one of the bosses in the bore. With the money he made there he went into business in Wisconsin, and became wealthy. He served successively as congressman, governor, and a member of President Harrison's cabinet.

As originally driven, the cross section of the tunnel does not provide sufficient clearance for modern locomotives and box cars, and for several years it has been necessary to route many trains over a longer course. It was therefore decided to enlarge the bore; and that work is now in progress. Inasmuch as only a small amount of material has to be removed from the sides and roof, the relatively soft sandstone is being scaled off with air-operated chipping hammers. Sixteen of these tools, all of Ingersoll-Rand manufacture, are in use and are supplied with air by two portable compressors, one at each portal. By this method explosives are eliminated and the work is being done with a minimum of traffic interruption.

Priorities and Rock Drills

THE task of keeping the national-defense program moving ahead at full speed without seriously interfering with normal industrial production is a prodigious one. It involves complex and difficult problems of which the average consumer is as yet little aware, but which are going to be brought home to him more and more as he finds he cannot obtain certain manufactured articles because special materials required for their making are no longer available.

The Office of Production Management has been created by the Federal Government to direct the flow of essential materials to products that are vital to defense. Those that are critical have been placed on a priorities list, and the Director of Priorities, or the Army and Navy Munitions Board, can, where they think conditions justify it, prevent suppliers of such materials from delivering them to manufacturers or processors except by specific permission. It is the intention of the Government, of course, to administer priorities so that all phases of the defense program will be adequately served. One of the chief difficulties in doing this is that it is not always readily apparent just how far the defense program reaches. Certain items such as ships, guns, and ammunition are obviously of vital importance: others that render less direct but equally valuable service are now being classified.

An example in point is the rock drill. It is clearly not a weapon of war in the sense that a rifle is, although it was an essential tool of sappers on the western front in World War I and was used only last month by Nazi invaders of Yugoslavia to widen roads to permit the moving of heavy tanks down the Struma River Valley. However, the role of the rock drill is greater behind the lines than in combat areas.

Minerals are indispensable to defense. Without iron, copper, lead, zinc, nickel, tungsten, and numerous other metals, the program now underway in this country would quickly bog down. And without rock drills the mining of the ores from which these elements are obtained would virtually stop. There is no disposition to limit the production of rock drills; but there is a possibility that drill manufacturers may be unable to secure the alloys without which their tools would lose much of their present operating speed and stamina.

To withstand the pounding action to which it is subjected, a rock drill must be built largely of special materials. Metallurgists have painstakingly developed these—in fact, the steel industry in general owes some of the advancement in alloys to the researches of rock-drill makers. Now it may soon be impossible for the industry that helped to originate these materials to obtain them. Nickel-steel is particularly important in a rock drill, being used in approximately 40 per cent of its parts. Nickel forms a solid solution with ferrite, giving desirable toughness that adds much to the performance and service life of drilling machines. Other elements will not produce the same effect, because they do not go into solution but form carbides instead. Alloys of molybdenum, silicon, and chromium also enter into rock drills. Tungsten steel is not required; but it is widely used in the high-speed tools that are employed in machining drill parts. It is likewise used in the inserts of dies for forging Jackbits.

Any slowing down in mining the ores of strategic metals would, in a relatively short time, retard the entire defense program. In fact, it is important right now that everything be done to speed up the breaking and hoisting of ore. As matters stand today, some of the alloys mentioned can no longer be furnished by the steel mills without a priorities order. Meanwhile the stocks of alloy steels, especially of nickel-steel, are in some cases sufficient for only a few weeks. Once those stocks are exhausted it will be necessary, if they cannot be replenished, to adopt substitutes. This would mean a drop in drilling efficiency, greater breakage of parts, and increased labor and expense in servicing drills.

The rock drill is as fundamental to metal mining as the plow is to farming. The use of a few ounces of suitable steel in a rock drill will add many tons to the store of ores from which similar steels can be produced for other purposes. It is to be hoped that the significance of the rock drill in the defense program will be fully recognized while there is still time to avert a shortage of high-capacity drills.

Versatile Petroleum

IN THE early days of petroleum production, crude oil was promoted as a cure-all for the ailments that afflict the human body. Medicine men sold it under such names as Rock oil, Seneca oil, and many others. It is not of record that it ever did anyone any good or any harm, although its smell and taste must have made those who took it think that it was really medicine.

Now, however, as the American Petroleum Institute points out, crude oil is living up to its advance notices. Chemists already derive from it such essential pharmaceuticals as novocain to thwart the dentist's probings; ichthyol, a healing salve; and formaldehyde, an antiseptic and a constituent of a healing compound. Glycol oleate, an emulsifier, contributes importantly to cosmetics, lotions, and brushless shaving creams. Other petroleum products are anaesthetics, perfumes, shampoos, and liquid rouge.

Among the latest discoveries is a method of making glycerine from petroleum refinery gases. Chemists are agreed that petroleum hydrocarbons offer an almost limitless field for research. They predict that from them we will some day derive sugars, starches, and other foodstuffs. This leads the A.P.I. to anticipate the time when filling-station signs will read: "Fuel for Man and Machine."

READY FOR LOWERING

To facilitate handling, the automatic tank-car cleaner is suspended from a crane (top). It is lowered partway through the dome to which it is clamped when in use. At the bottom is seen the nozzle, which revolves in two concentric circles when in action and reaches every part of the interior surfaces. The picture plainly shows the force with which the cleansing streams are ejected from the two jets.

Tank Car Cleaner

FOR cleaning the interior surfaces of tank cars, Oakite Products, Inc., has developed a method and equipment available on a rental basis. The Oakite Interior Tank Cleaning Unit, Model 324—to give it its full name—is operated by an air motor with air at from 40 to 60 pounds pressure, and is lowered into a car so that the 2-jet nozzle is midway between the top and bottom. The jets face in opposite directions, and when the work starts are pointed straight up and down. As the nozzle revolves, powerful streams of a hot Oakite solution, hot water, and cold water are, in turn, directed against the surfaces, effectually removing from every square inch of them, it is claimed, any oil or grease deposit of vegetable or mineral origin no matter how hard it is dried on. The loosened material is washed out into a catch box—the cleaning solution flowing by gravity back into the tank from which it was originally pumped. Depending on the condition of the car, it is circulated from ½ to 1 hour, the entire process, including rinsing, some scraping and flushing of the bottom by hand, and drying, normally taking from 1½ to 2 hours.

Rotproofing Sandbags

IN a previous issue of COMPRESSED AIR MAGAZINE we made brief mention of the fact that Imperial Chemical Industries had developed a method of rotproofing sandbags. Detailed information was lacking at the time; but we can now give the formula of the mixture used and how it is applied. Either 4½ pounds of soda ash or 11½ pounds of soda crystals are dissolved in 5 gallons of water and stirred slowly into a solution of 10 pounds of copper sulphate crystals in 30 gallons of water. A wooden vessel must be used; and when the mix is made up in 40-gallon quantities, there should be added 2 ounces of Calsolene Oil HS, a wetting agent that speeds up penetration. This is further promoted by heating the water to a temperature of from 85 to 100°F. When mixing with cold water, the bags should be allowed to soak for at least five minutes.

The empty bags are immersed in the solution until thoroughly saturated. In case the bag material is sewed after treatment, it is necessary also to immerse the thread, as rotting often begins at the seams. The excess liquor is removed by wringing, or in a hydroextractor, and at that stage the bags should be twice their original weight. After drying at a low temperature they are ready for use. In the course of the investigations, treated and untreated jute and cotton bags were buried side by side in garden soil for as long as eight months. At the end of that time, according to Imperial Chemical Industries, the rotproofed fabrics were found to be in excellent condition while little remained of the controls. The cost of the treatment at the then prevailing market prices of the materials was not more than one-tenth of a penny (equivalent to 0.002 cent in United States currency) for a bag of normal size.

Magnetic Force Gauges Thickness of Sheet Metal

THANKS to a new magnetic gauge invented by W. E. Abbott and B. M. Smith of the General Electric Company, it is now possible to measure the thickness of sheet steel when only one side is accessible. The instrument consists of a 7-pound recording unit which is connected to an electric outlet, and of a small cylindrical head containing an alnico magnet. When the gauge head is placed against a magnetic sheet or plate that is not backed by another magnetic material, the steel becomes saturated with the permanent magnetic field of the head, the amount passing through the latter depending upon the sheet's thickness. The thickness is indicated by the instrument reading, which is a measure of the increased reluctance of the magnetic circuit.

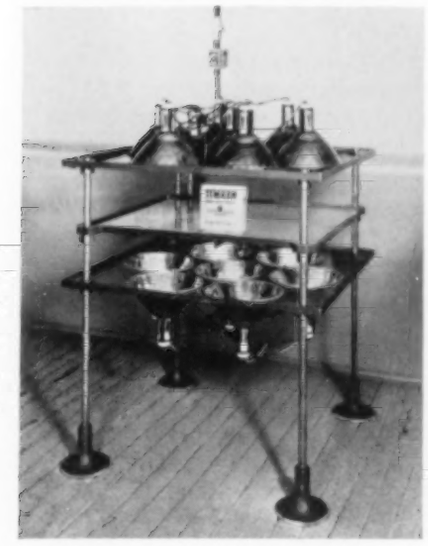
The first gauge made has two scales, one with a range of 10 to 25 mils (0.01 to 0.025 inch) for electrical sheet steel of medium-silicon content, and the other of 20 to 45 mils (0.02 to 0.045 inch) for either cold- or hot-rolled low-carbon steel. However, instruments can be provided that will measure with the same relative accuracy thicknesses up to 250 mils (¼ inch) and even thicker. In the latter case, portability has to be sacrificed because a larger gauge head is required to assure saturation.

NO CALIPERS NEEDED

This new magnetic gauge will measure the thickness of sheet steel when brought in contact with only one side of it. The instrument is portable, and is said to be accurate within one-thousandth of an inch.

Industrial Notes

For heating bearing cones preparatory to assembling them on shafts where a tight press fit is required, The Timken Roller Bearing Company has developed the ingenious device shown. It consists of three trays, each about 4 feet square, arranged in tiers approximately 1 foot apart. The middle shelf is of pyrex glass, and the top and bottom trays carry special, 250-



watt infrared-ray lamps with gold-plated reflectors. There are seven bulbs in each tray, and they are set so as to face one another, with the bearing cones between them. The cones are given the heat treatment stacked in their boxes, which remain relatively cold in the course of the twenty minutes or so that it takes to bring the bearings up to a maximum temperature of 155°F. With this method of heating it is not necessary to wash off the protective coating put on the bearings at the time of packing.

We are informed on good authority that it is bad for automobiles to be left outdoors all night. Tests conducted in Florida with the aid of artificial dew and a sunshine-intensity meter showed that exposure from midnight to noon is harder on the finish than exposure from noon to midnight. Sunshine and dew do the harm; and the latter is more damaging than rain.

We may soon be wearing garments of rayon made of seaweed, if news reports from England be correct. It is of interest to the mining industry because the new yarn from which the fabric is woven calls for the use of beryllium to render the textile washable. The solution from which the new filament is produced is sodium alginate, which can be spun by the existing rayon machinery. The quality of the yarn, however, depends on the composition of the coagulating bath; and it has been found that yarn hardened with beryllium acetate has the best all-around characteristics.

Switzerland is offering housewives a premium on empty tin cans without tops and free of dents. They are refilled after they have been cleaned with steam and sprayed inside with a special lacquer that is burned in at a high temperature.

Flexseal is the name of a new laminated safety glass in which one or more layers of plastic, sandwiched between the glass sheets, extend beyond the edges of the latter. The rim is flexible and permits the use of nails or screws.

Metal scrap in strips or strings can be rolled into compact cylinders each measuring 16x18 inches and weighing from 200 to 300 pounds. The new bundling machine by which this is done will, it is claimed, take either bunched or stringy material.

By leaving a film on workers' hands, a new water-white liquid into which they are dipped is said to serve the dual purpose of protecting the skin from harm and such delicate metal objects as precision ball bearings, etc., from perspiration and, possibly, rust.

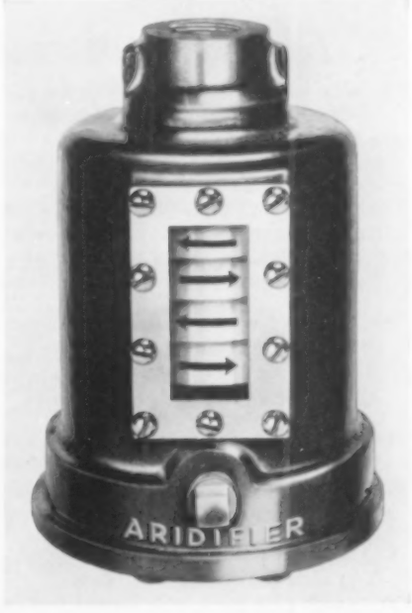
Fusol is the name of a sludge solvent for heavy fuel oils such as Bunker C. In addition, it is said to prevent carbon formation in preheater tubes and oil burners. It has been put on the market by the Maxfal Chemical Company, and is added in the proportion of 1 quart per 1,000 gallons before and 1 pint per 1,000 gallons after the sludge has been dissolved.

Fogging and steaming of spectacles and lenses of goggles, masks, etc., can be prevented, it is claimed, by a material in stick form produced by Continental Laboratories. It is rubbed on the lenses, after which they are polished, one application remaining effective for approximately twelve hours. Industries that might find considerable use for a preparation of this kind can obtain a sample upon request.

Chicago, Ill., because of its location, is the center of the nation's air traffic and is considering the construction of a double-track tunnel 10 miles long in solid rock 130 feet below street level. The project has been proposed by the well-known engineer Joshua D'Esposito, and would link the municipal airport with the busy Loop District in the heart of the city. The plan is to transport passengers and mail in electrically operated rocket-shaped cars at a speed of 90 miles an hour, or in 6½ minutes from terminal to terminal. It now takes about six times that long to make the run by automobile during the rush hour. By sinking a number of shafts and driving the tunnel from several headings simultaneously it could be completed in eighteen months at an estimated cost of $8,000,000.

Metallic surfaces exposed to temperature variations will sweat and drip, as most of us know. A ⅛-inch-thick finish of plastic cork, known as Insulmat No. 595, will stop these harmful reactions, says J. W. Mortell Company. The material requires no priming coat, is self-bonding, and can be applied to any clean metal surface with ordinary air-spray equipment. In addition, it is claimed to be odorless and verminproof, to help deaden sound, and to seal joints against air and moisture.

To show prospective users just what happens inside an Aridifier air cleaner, and to prove that back pressure is a negligible factor, the Logan Engineering Company has taken a standard model and set a window in the housing to make the rotors visible. There is an arrow painted on each rotor, and this indicates the direction of rotation and how each quickly picks up speed when air is fed into the line. When they have reached operating speed, the several rotors can be seen discharging drops of water and oil from particles of dirt as they are removed from the air stream and deposited in the dead-air zone. It is claimed that units of this type will remove all con-



densed moisture, oil, and fine scale from air and gas lines, and that they need no attention other than periodically draining the water and dirt that accumulates in the trap.

—AIR JETS—

"Shut 'er off Bill! I want to hear the splash."

AN IDLE DREAM

I wish I could dope out some logical ways
  To shake the darned job for at least thirty days,
Knowing someone would not phone in the night
  Saying, "Bill, the big Diesel is not running right."

I'd hitch to my trailer and away I would sneak
  And pitch me a camp on the bank of some creek.
Then I'd settle me down for a quiet peaceful wait
  'Till the fish took a notion to fool with my bait.

I wouldn't be hearing the loose pistons pound
  Nor think "The darned outfit is sure going down;
Number two needs new liners and a new camshaft gear.
  I sure hope the load don't increase much this year."

I'd forget about liners that scale up too soon,
  And fuel that you can't even stir with a spoon,
Because on occasions the oil is so thick
  You know it's a cinch that fuel pumps will stick.

I'd fish and I'd sleep and I wouldn't be there
  When some air compressor refused to pump air
Because the high pressure valve sprung a leak,
  No, I'd be fighting mosquitoes out there on the creek.

But after a week I would have quite enough,
  Then I'd pack up my tackle and other camp stuff
And head out for town and start hitting the ball
  For there's going to be hell around here before fall.

And then again next year I will have the same yen
  And my wife will remind me of another time when
I went for a month and came back in a week
  Because I can't make a living out there on the creek.

But one can keep wishing for it—don't cost a thing,
  And some time this winter or maybe next spring
We'll have a new engine to help pull the load.
  Then I'll hitch to the trailer and take to the road

Still hunting for creeks where mosquitoes don't bite
  Where the fishing and water and shade are just right;
And year after year it will be the same thing,
  For the bug always bites me some time in the spring.

—BILL ELLIOTT
in Diesel Progress

THE MINER'S LAMENT

(From The Engineer's Bulletin)

The rock is hard and tough to break,
  The men are mean from muscle ache.
The supers gripe, the shifters swear,
  Machine men howl and tear their hair.

The chutes won't pull, the trammer's mad,
  He takes him "five" and thinks, how sad!
The air is vile and full of smoke,
  To work in it, is sure no joke.

The mucker's weak and shakes his head,
  Wishes to heck that he was dead.
The hoist man smiles, and rolls a smoke,
  And takes a seat, and cracks a joke.

But he's on top, can see the sun,
  Don't have much work, but lots of fun.
No rock can fall on his bald head,
  He might as well be home in bed.

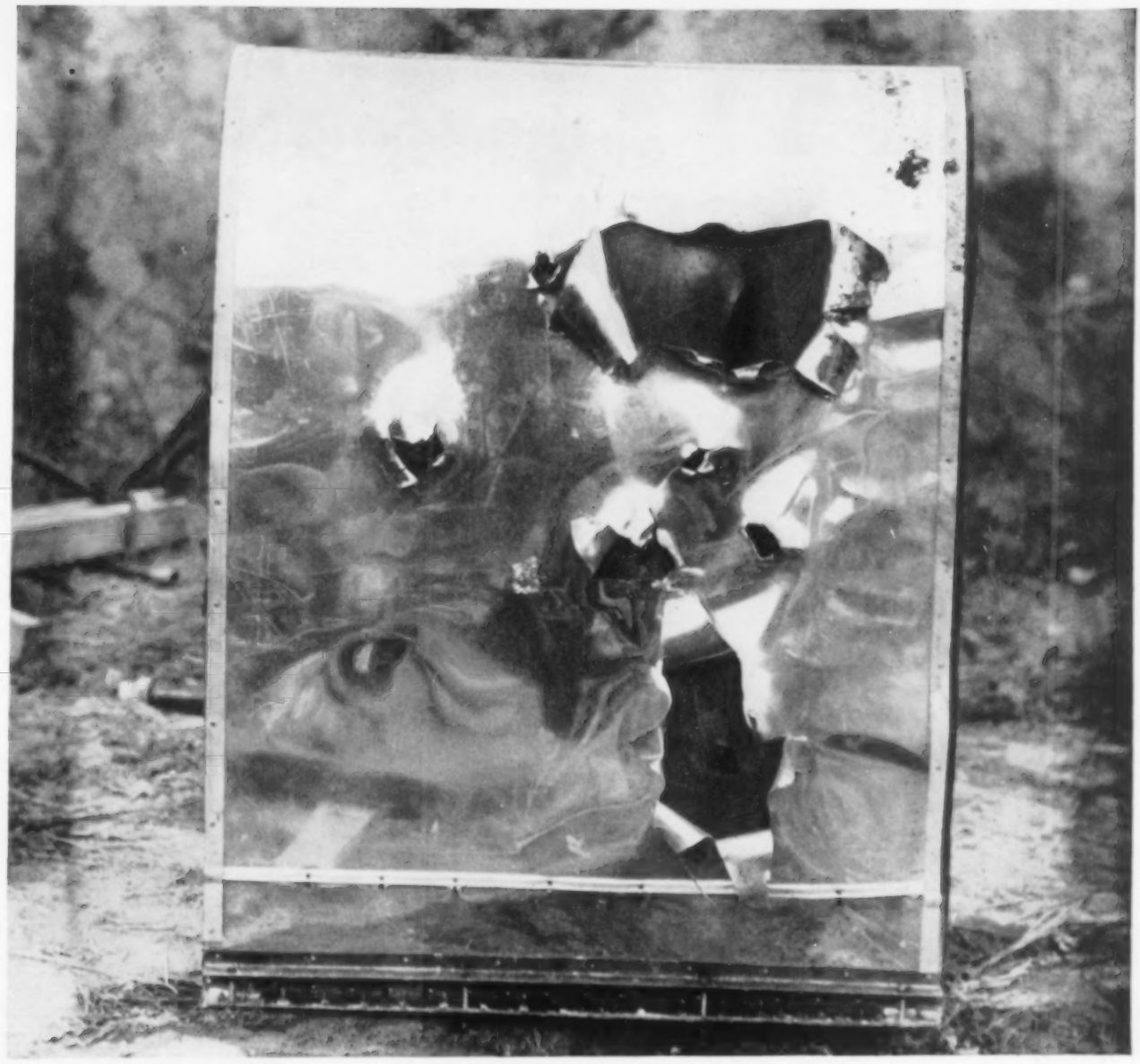
You have nightmares, and cannot sleep,
  You kick the covers in a heap.
Your wife gets mad, and throws you out,
  Your teeth are gone, you get the gout.

Then soon you die, and up you soar,
  To crash St. Peter's pearly door.
St. Pete, he says, "And who are you?
  Where are you from, what do you do?"

You hang your head, and say in shame,
  "Minin's the work, Jones is the name."
St. Pete looks sad, and shakes his head,
  "Too bad, my boy, that you are dead.

I'll have to send you down below,
  A trammin' coal, you so and so."
And now you see, the reason why,
  My boy won't be no minin' guy.

"I gotta a date with me goil, Admiral, so I hafta finish this in a hurry."



Rubber swallows bullets that rip metal in airplane tanks

A typical example of Goodrich development in rubber

TERROR of every war pilot is a bullet in his gas tank. With fuel gone he's forced down, perhaps on enemy territory, and the gas leak usually means fire and death.

Long before this war started, Goodrich engineers were working with U.S. aviation officials on means to seal gas tanks. Goodrich had developed a puncture-sealing tube for tires—why not a puncture-sealing tank?

Trouble was that big machine-gun bullets used in war today don't cause a simple puncture—they *blast* great gaps in anything they hit. Look at that airplane tank in the picture.

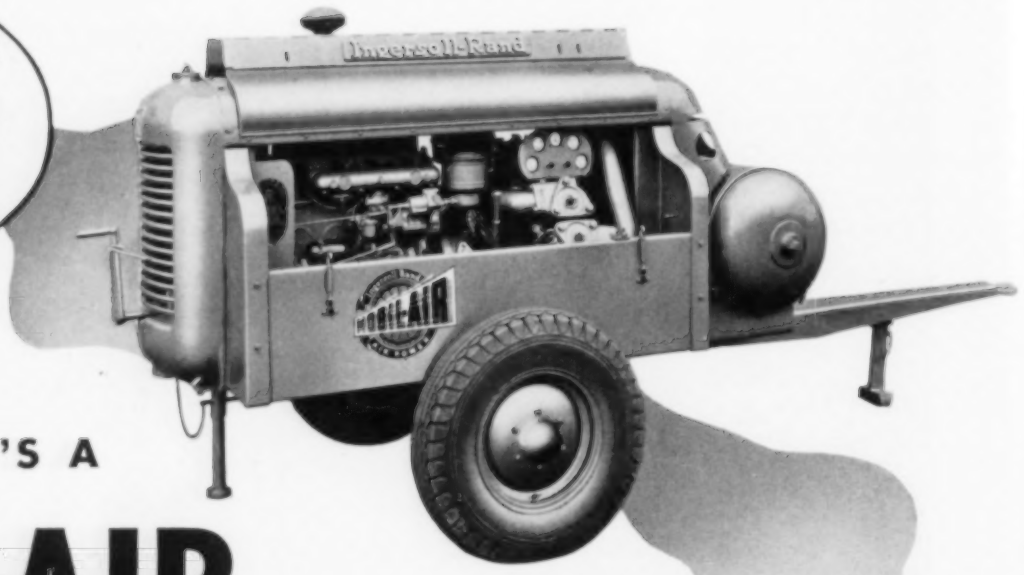
For two years Goodrich engineers worked on the problem. Finally after countless experiments they developed the rubber constructions they were seeking—linings stiff enough to keep their shape yet so soft they instantly "flow" to close gaps made in them, even though punctured again and again. Among the compounds used is a synthetic which had already been tried out and proved in Goodrich airplane De-icers; another is the new Goodrich Ameripol, the synthetic with best resistance to the deteriorating action of gasoline.

Tanks were lined with these new Goodrich constructions. Above you see one of them after a proving-ground test—the metal ripped and torn, but the rubber lining actually holding gasoline as safely as though no bullet had ever been fired. *The B. F. Goodrich Company, Mechanical Goods Division, Akron, Ohio.*

B.F. Goodrich

First in Rubber

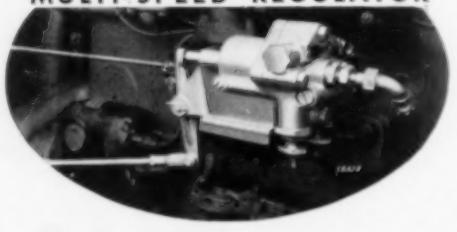
WHAT A *man* inside the compressor ?



Yes IF IT'S A MOBIL-AIR

you get a *built-in man* which we call the

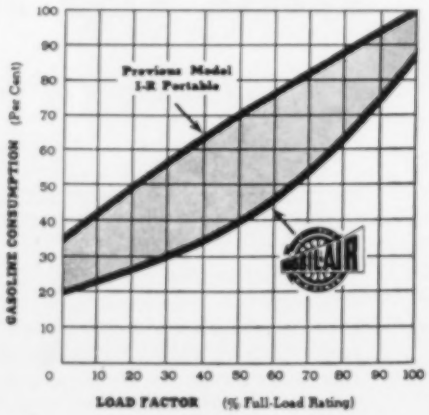
DRILL-MORE MULTI-SPEED REGULATOR



- **Saves fuel wasted in idling periods**—Everytime a portable compressor "unloads" the fuel that keeps it "idling" is wasted. You could save most of this fuel by hiring a man to keep his hand on the engine throttle, and slow down the machine each time the pressure approaches the unloading point. But . . . on the smaller units the man's time would wipe out the saving, and he would probably stall the unit.
- **Three working speeds**—In the K-Series MOBIL-AIR we give you a "built-in man"—the DRILL-MORE Multi-Speed Regulator—to make this saving for you. This simple device provides three working speeds—full, intermediate and low—and automatically selects the slowest and most efficient speed that will maintain the required air pressure. The MOBIL-AIR never unloads and idles unless the low speed produces more air than is being used. It reloads at the slow speed, instead of accelerating to full speed, and when greater capacity is required, the machine automatically speeds up.
- **Compressor lasts longer**—Since most portable compressors operate much of the time at part capacity, the average working speed of the compressor and engine is thus slower and more efficient. Idling is practically eliminated while air is being used. Wear and tear is reduced. The machine lasts longer.
- **Maintains higher and more uniform pressures**—Another advantage of the DRILL-MORE Regulator is its ability to maintain higher and more uniform pressures, resulting in up to 15% faster drilling with Jackhamers and similar air tools.

Ask our representative to show you the convertible engine, the new self-adjusting non-lubricated clutch, and the many other distinctive MOBIL-AIR features.

Gives you a new low in operating costs



Combining the economies of a new-type gasoline engine, a NEW two-stage air-cooled compressor and the DRILL-MORE Regulator, the MOBIL-AIR saves up to 40% in gasoline costs.

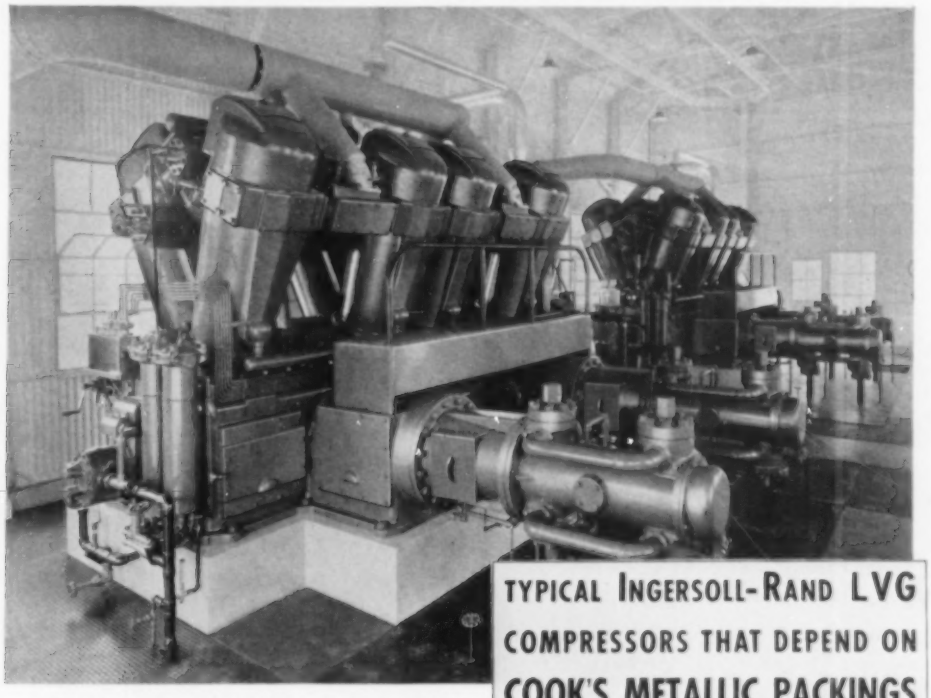
Ingersoll-Rand

11 BROADWAY, NEW YORK CITY

2-39

A Complete Line of Two-Stage Air-Cooled Portables . . . 60 to 500 cfm.

53 YEARS MANUFACTURING EXCLUSIVELY METAL PACKINGS FOR PISTONS AND RODS

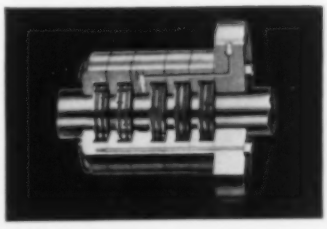


—Photograph courtesy Ingersoll-Rand Co.

TYPICAL INGERSOLL-RAND LVG COMPRESSORS THAT DEPEND ON COOK'S METALLIC PACKINGS FOR EFFICIENT, RELIABLE PERFORMANCE

More

RECYCLING COMPRESSORS . . . *fitted with* COOK'S METALLIC PACKINGS



●COOK'S *Annular Cup Type Packing shown above is one of a complete line fitted with packing rings of exclusive design and materials that impart longer ring life—provide maximum seal—eliminate rod scoring. There is a proven style of* COOK'S *Packing for all engine and compressor service requirements.*

THE selection of COOK'S Metallic Rod Packings for these new LVG recycling units and the full line of LVG Compressors is another fine recommendation for COOK'S Packing. Yet Ingersoll-Rand Company knew, from the performance of COOK'S Packings on the XVG Compressors, that these packings will assist these larger machines to operate at maximum efficiency with minimum upkeep expense.

Performance tells—just as COOK'S Packings have been the choice of leading builders and operators of all types of engines and compressors for over 50 years—they have been the choice also for high pressure units on over 95% of the machines built for this service.

Many engines and compressors are delivered factory equipped with COOK'S Packing—others come COOK equipped on request. When you order new equipment, specify COOK'S Metallic Packings by name—just to make sure you get the genuine. For equipment in service, order COOK'S Packings from your engine builder or write us direct.

SEALING PRESSURES SINCE 1888

C. LEE COOK MANUFACTURING CO.
INCORPORATED
New York Cleveland Los Angeles Baltimore **LOUISVILLE, KY.** Chicago Tulsa New Orleans San Francisco

Have You Tried a POWERPLUS Vertical Grinder?
ROTOR TOOL COMPANY
CLEVELAND, OHIO
PORTABLE AIR TOOLS
HIGH-CYCLE ELECTRIC TOOLS

Ring-up JOHN CRANE Packing

302 scientifically engineered styles.....

25 year-experience-file answer all calls

● Stores which carry the largest selections satisfy the largest number of customers. Similarly John Crane Packing, offering an assortment of 302 distinct styles, corrects practically 100% of sealing problems encountered—not alone because of variety, but also because 25 years of intimate experience with thousands of conditions, has designed efficiency into these many styles . . . Moreover, should some acute problem arise, our chemists and technicians are available for consultation: survey, analysis and recommendation—all without charge . . . In an emergency, or to improve your present operating status, *ring-up* John-Crane-Packing

JOHN CRANE
Industrial Packings

STEAM	WATER	AIR	OIL	CHEMICAL
6 AM	110	SS#1	SS#2	SS#1
250	115	6 AM	100	100
2150	140	100 EO	110	100 MP
555	174	172	115	110
1151	400	222	126	333
100	400 EO	300	150	560
100 MP	560	300 EO	172	804 D
126	751	333	250	805 M
150	805 MBF	400	444	810 W
300 EO	810	400 EO	550	812
550	843		560	896
560	844		804 D	
601 E	845			
602 G	861			
800	862			
802	864			
804	880			
814	1015			
820	1033			
832				
873				
878				
881				
997				

(ILLUSTRATED)

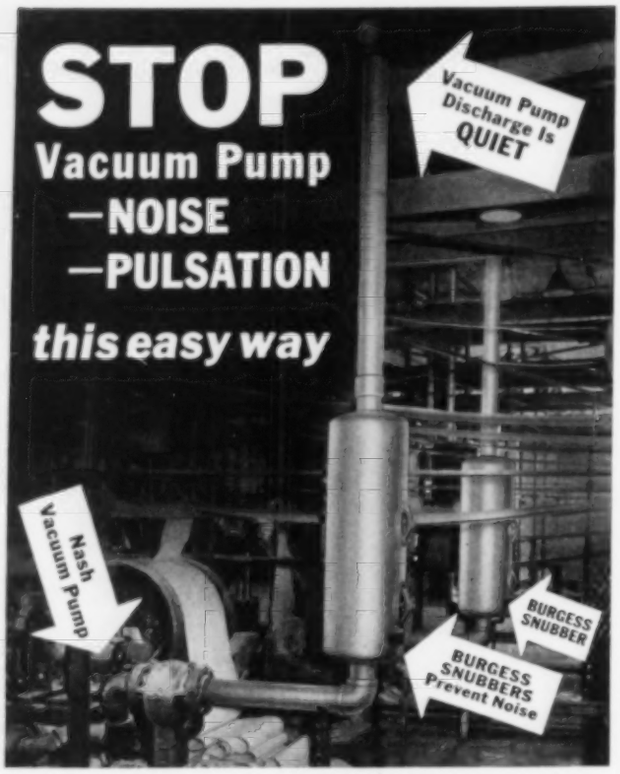
JOHN CRANE STYLE 100

All-Metallic Packing . . . Temperatures to 450°F

Style 100 is a flexible, all-metallic packing made by spirally wrapping thin ribbons of soft babbitt foil, layer-over-layer construction, and squared to desired diameter . . . Each layer is lubricated with oil and graphite . . . Style 100 is a perfect, lubricated and babbitted bearing, as well as a perfect packing.

Service: Pumps: H. P. Hydraulic, centrifugal oil, and pipe-line . . . Steam turbine shafts . . . Corliss valve stems . . . Valve stems . . . Expansion joints . . . Air compressors

CRANE PACKING COMPANY, CHICAGO, U. S. A.
CRANE PACKING COMPANY, LIMITED, HAMILTON, ONTARIO, CANADA



Two L-6 Nash vacuum pumps at United Wallpaper Factory in Chicago produce the vacuum which controls the movement of wallpaper as it is printed. Burgess Snubbers completely stopped all objectionable noises.

SNUB High Velocity Impulses for a Quiet Discharge

Sectional view of Burgess SDHC Exhaust Snubber.

Your vacuum pump discharge can easily be made quiet. Just install a Burgess Snubber. It will prevent annoying discharge noises and pulsations in your plant.

Burgess Snubbers give you a quiet vacuum pump discharge, because they smooth out the flow of evacuated air. High velocity air impulses are snubbed to a smooth stream. Objectionable pulsations are completely prevented, and there is no noisy impact with the atmosphere.

Burgess Snubbers will solve your toughest discharge noise problem. Use them to quiet the pulsating pump discharge without causing restriction to air flow.

We shall be glad to send information on this new method of quieting noisy air streams. A bulletin will be sent on request.

Burgess Battery Company, Acoustic Division, 510 W. Huron St., Chicago, Ill.
Originators of Snubbing Principle for Quieting Diesel Exhausts
Pat. & Pats. Applied For

BURGESS
INTAKE AND EXHAUST
SNUBBERS

STOP that NOISE! Noise Abatement Week—June 1-7

ALUBRO-WELD GLASS
for Aluminum and Bronze Welding

Willson Fibre Spectacles with Alubro-Weld Lenses

Alubro-Weld, a blue glass, scientifically compounded to filter out dangerous rays of light, is especially recommended for aluminum and bronze welding and other industrial operations where an intense sodium yellow glare is present. Though Alubro-Weld blocks out all ultra-violet rays and greatly reduces infra-red ray transmission, it has a much higher visible light transmission than ordinary blues. As a result, welders on aluminum and bronze work can far better see their work, the flow of metal can be more accurately controlled, and corrective grinding operations are reduced to a minimum. May be had in various sizes to fit all types of goggles.

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READING, PA., U.S.A. Established 1870

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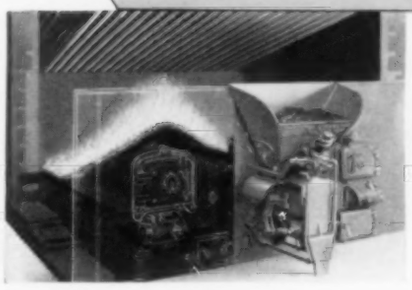
"TOLEDO"

IN THE SINGLE RETORT AND SPREADER FIELD

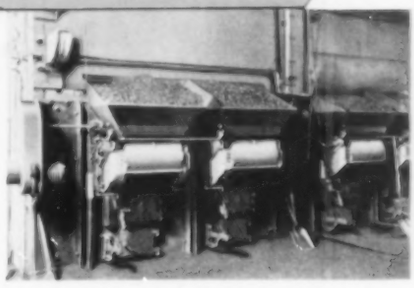
Here's your Stoker



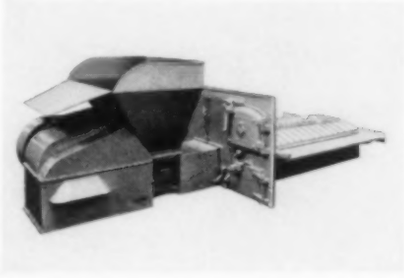
TYPE E

TYPE E A center retort, underfeed stoker designed to burn either coking or non-coking bituminous coals. Applicable to boilers ranging from 150 to 600 rated boiler hp. It is the best known and most widely used of all underfeed stokers and has been the recognized leader in its field for the past quarter century. This C-E Type E Stoker is available with either integral steam piston, electric or hydraulic drive.

SPREADER Combining the advantages of burning fine coal in suspension and coarser particles on a grate, the C-E Spreader Stoker has an unusually wide range of application. It is suitable for boilers ranging from about 150 rated hp up to the largest sizes of stoker fired units. The C-E Spreader Stoker burns all types of both bituminous coal and lignites. It embodies special features of design and construction which make for reliability and efficient performance.



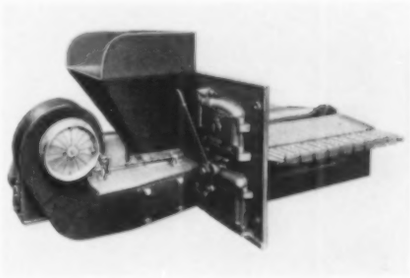
SPREADER



SKELLY

SKELLY The C-E Skelly Stoker is for the range of service from small heating boilers up to units developing 400 hp. It is the outstanding value in the smaller stoker field with many features ordinarily associated with big stoker operation. It is serving factories, laundries, dairies, greenhouses, hotels, warehouses and all kinds of institutions. It is available with either electric or steam drive in three different types: center retort, or side retort, each with moving grates; side retort with stationary grates.

LOW RAM A ram type, underfeed stoker designed to burn either coking or non-coking bituminous coal under boilers rated up to 250 hp. Low and compact, it is especially suitable for low-set water-leg heating boilers where head room and furnace volume are limited. Notable for rugged construction, simplicity of operation and accessibility of all vital parts. Available in center-retort and side retort types.



LOW RAM

WHY SAY "Here's your stoker" and point to four of them? Because only *one* stoker will suit *your* needs exactly. Hence the advantage of selecting a stoker from the extensive C-E line. You get *the* stoker best suited to *your* conditions – designed to burn *your* coal – to fit *your* boiler – to operate efficiently under the load conditions at *your* plant.

When C-E engineers offer recommendations to a prospective stoker purchaser they have complete freedom of choice. If, for example, conditions indicate the use of a single-retort underfeed or a spreader stoker they have a complete range of types and sizes to choose from as illustrated and briefly described above.

All four of these stokers are built to the high standards of design and workmanship that distinguish C-E equipment in the field of steam generation. Collectively they are serving hundreds of industrial plants throughout the country. They are establishing records for dependable performance, low operating costs and minimum maintenance which prove them to have been wise investments for their owners.

Viewed from the angle of experience, C-E is exceptionally well qualified not only to make recommendations of the most suitable size and type but to design, build and install stokers correctly. C-E's stoker background covers more than forty years of experience with stokers of all types and includes, in addition to these four, multiple retort designs and both bar and chain-type traveling grates.

Write for additional information. A-572

Over 16,000 C-E stokers have been installed under boilers with a total rated hp of 4,500,000

COMBUSTION ENGINEERING

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C-E PRODUCTS INCLUDE ALL TYPES OF BOILERS, FURNACES, PULVERIZED FUEL SYSTEMS AND STOKERS; ALSO SUPERHEATERS, ECONOMIZERS AND AIR HEATERS

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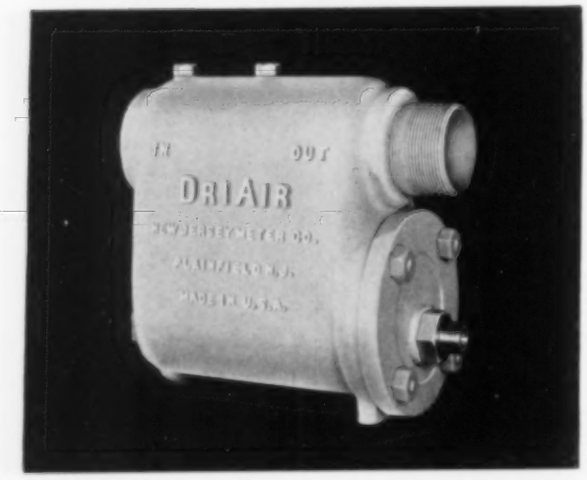
GREATER PNEUMATIC EFFICIENCY



A typical installation showing DriAir standing on the floor next to the wall.

DriAir may be installed by suspending it from the piping without any other support.

WHEN EQUIPMENT IS PROTECTED BY

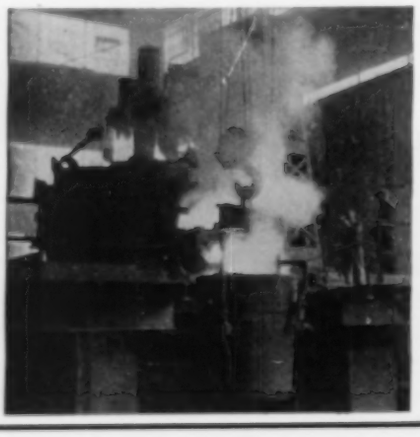
DRIAIR

SEPARATES • COLLECTS • DELIVERS

DriAir separates and automatically ejects the condensed water and oil from compressed air lines, collects pipe scale and rust, delivers clean dry air to tools and other pneumatic equipment. This promotes better lubrication, reduces wear, increases life of tools and produces greater output. All internal parts are made of bronze or copper—resistant to corrosion and practically permanent.

Write for Bulletin DA which fully describes the construction and operation of the DriAir.

NEW JERSEY METER COMPANY
PLAINFIELD, NEW JERSEY



Control

—right from the start for—

BASIC ELECTRIC STEEL FORGINGS

COMPLETE control of all processing from selection of the melting charge to the finished condition is the N. F. & O. *guarantee of quality* in forgings furnished to your specifications–Smooth Forged, Hollow Bored, Rough or Finished Machined.

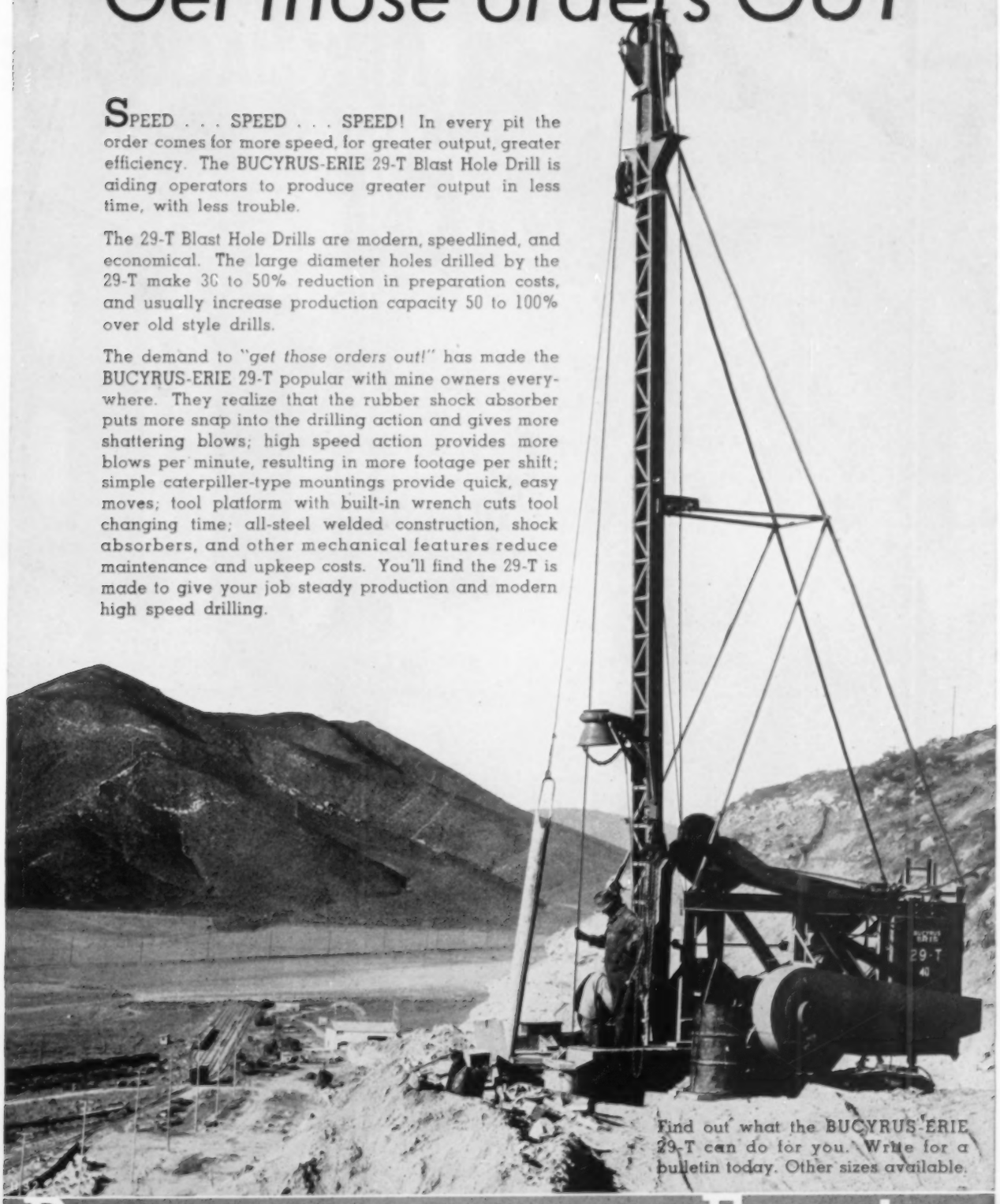
NATIONAL FORGE & ORDNANCE CO.
IRVINE, WARREN COUNTY, PENNA. U. S. A.

"Get those orders OUT"

SPEED . . . SPEED . . . SPEED! In every pit the order comes for more speed, for greater output, greater efficiency. The BUCYRUS-ERIE 29-T Blast Hole Drill is aiding operators to produce greater output in less time, with less trouble.

The 29-T Blast Hole Drills are modern, speedlined, and economical. The large diameter holes drilled by the 29-T make 30 to 50% reduction in preparation costs, and usually increase production capacity 50 to 100% over old style drills.

The demand to *"get those orders out!"* has made the BUCYRUS-ERIE 29-T popular with mine owners everywhere. They realize that the rubber shock absorber puts more snap into the drilling action and gives more shattering blows; high speed action provides more blows per minute, resulting in more footage per shift; simple caterpiller-type mountings provide quick, easy moves; tool platform with built-in wrench cuts tool changing time; all-steel welded construction, shock absorbers, and other mechanical features reduce maintenance and upkeep costs. You'll find the 29-T is made to give your job steady production and modern high speed drilling.



Find out what the BUCYRUS-ERIE 29-T can do for you. Write for a bulletin today. Other sizes available.

Bucyrus-Erie

SOUTH MILWAUKEE, WISCONSIN

Introducing

A NEW JACKHAMER

IN THE 55 POUND CLASS

JB

Ingersoll-Rand

11 BROADWAY, NEW YORK, N. Y.

5-6

MORE FEET OF HOLE PER SHIFT

-5 EASIER HOLDING

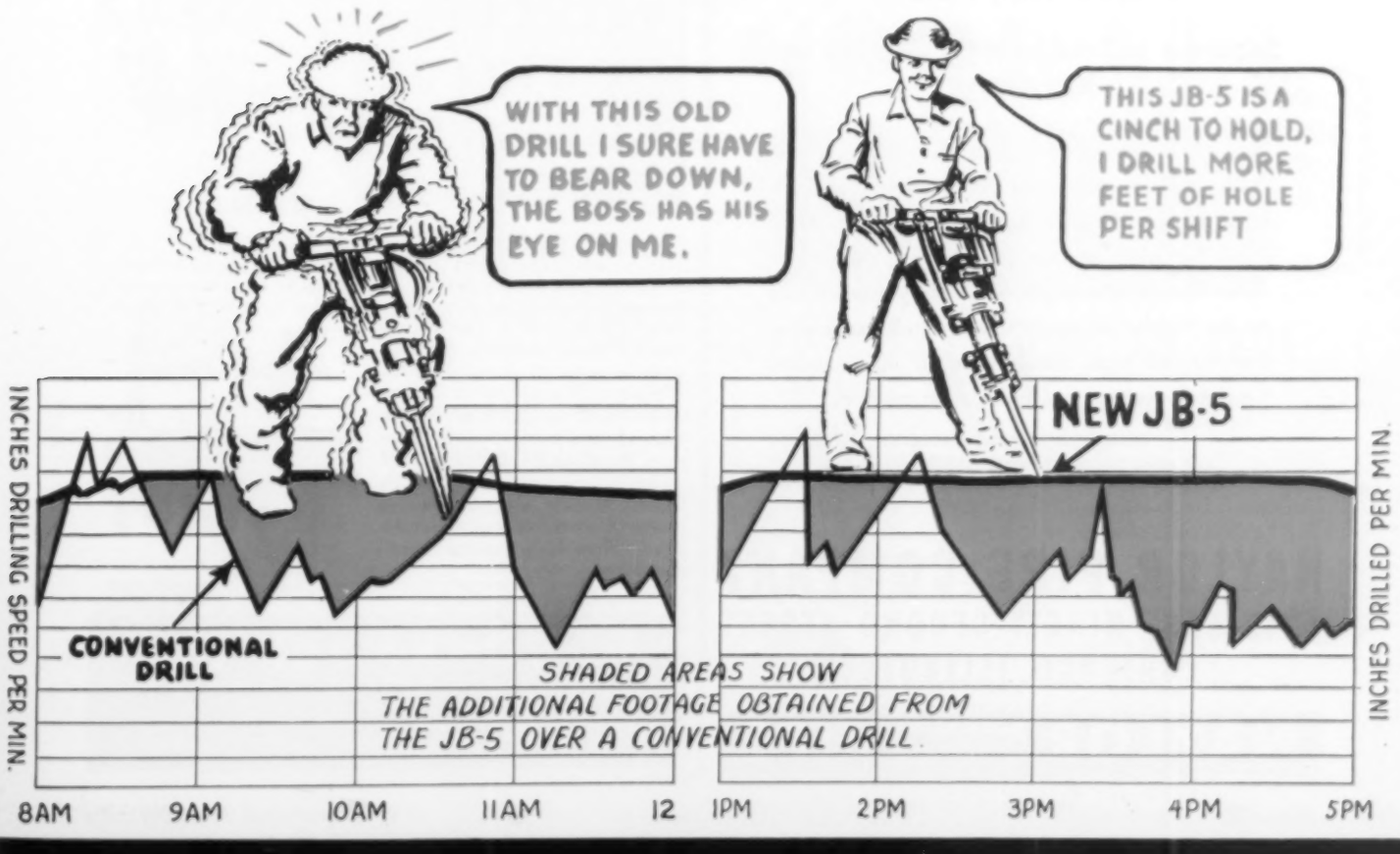
LOWER UP-KEEP COSTS

THERE IS A BIG DIFFERENCE

THE Jackhamer is a hand held drill. In operating it, human arms, legs and backs become the mounting—thus a man's size and strength limit the drilling capacity.

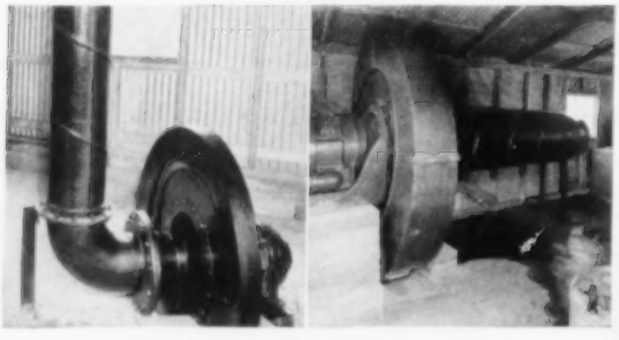
In the past, few operators had the strength and endurance needed for top performance of a 55 lb. class hammer throughout the shift. The result was less drilling, excessive fatigue and high upkeep costs.

Today's new Jackhamer, the JB-5 is so designed that the average size man can comfortably handle its full power all day long producing more feet of hole per shift with less upkeep costs. Send for Bulletin No. 2734.


WITH THIS OLD DRILL I SURE HAVE TO BEAR DOWN, THE BOSS HAS HIS EYE ON ME.
THIS JB-5 IS A CINCH TO HOLD, I DRILL MORE FEET OF HOLE PER SHIFT
INCHES DRILLING SPEED PER MIN.
CONVENTIONAL DRILL
NEW JB-5
INCHES DRILLED PER MIN.
SHADED AREAS SHOW THE ADDITIONAL FOOTAGE OBTAINED FROM THE JB-5 OVER A CONVENTIONAL DRILL.
8AM
9AM
10AM
11AM
12
1PM
2PM
3PM
4PM
5PM
8 HOURS DRILLING SHIFT

YOU GET ALL-OUT PERFORMANCE FROM NAYLOR LIGHT-WEIGHT PIPE

Greater Strength for High or Low Pressure Lines



Exclusive Safety Features

Economies in Transportation, Handling and Maintenance

No other light-weight pipe can give you the ALL-OUT performance provided by Naylor's exclusive Lockseam Spiralweld structure. It is ideal for high or low pressure air and water lines. Its extra strength and safety enable you to use Naylor on applications usually requiring heavier-wall pipe. Sizes: 4″ to 30″ in diameter. Complete fittings and fabrication service.

WRITE FOR NAYLOR CATALOG
OR SEND SPECIFICATIONS FOR QUOTATION.

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1245 EAST NINETY-SECOND STREET
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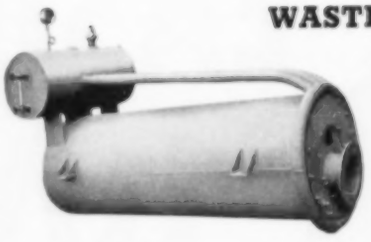
NAYLOR LOCKSEAM SPIRALWELD **PIPE**

MAXIM



WASTE HEAT BOILER

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SIMPLE TO INSTALL

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EFFICIENT

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CUTS WASTE

•

FOR HOT WATER

•

FOR STEAM

Why let valuable exhaust heat slip away when you can put it to work for you making hot water or steam? The new Maxim waste heat unit combines efficient silencing (and, where desirable, a positive spark arrestor) with the conservation of waste heat. It's worth investigating. Write for details today.

THE MAXIM SILENCER CO.
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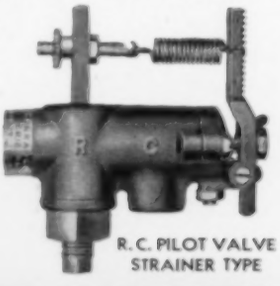
R-C Unloader Pilot Valves (plain or strainer type) are standard on many leading compressors . . . installed as replacements on thousands of compressors in all parts of the U. S. A. and overseas. The R-C valve—positive in action—cannot chatter . . . it's always in open or closed position. Adjustment is provided for any unload-to-load range from 3% to 30% of maximum receiver pressure. Install an R-C Unloader Pilot valve—let performance prove its value. Specify air pressure and range of on-and-off operation desired. Write for price and recommendation.



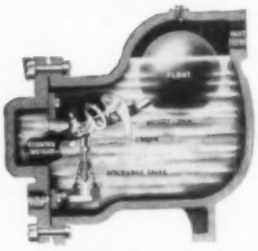
R. C. PILOT VALVE
STRAINER TYPE

R. CONRADER CO.
1207 FRENCH STREET - ERIE, PA.
PILOT VALVES for Portable and Stationary Air Compressors provided with Unloaders

MODEL JR

"NICHOLSON"

COMPRESSED AIR TRAP



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Bulletin No. 341 on request.

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W. H. NICHOLSON & CO.

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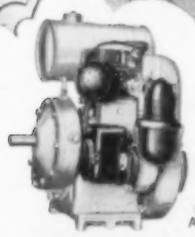
Road Marker powered by single cylinder Wisconsin Air-Cooled Engine.



Models AA, AB, AK
1½ to 4 hp.
Single Cylinder
4 Cycle

Non-stop performance when you need it, under any weather extremes . . . that's what we mean by "HEAVY DUTY" as applied to Wisconsin air-cooled engines (1 to 35 hp.). They are built to "take it" . . . and to keep on taking it 24 hours at a stretch, day after day . . . if that's what the job calls for.

If this is the kind of power you need for your kind of equipment, specify "Wisconsin". For detailed data, write: Dept. D-5.

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HEAVY-DUTY AIR-COOLED ENGINES

by WISCONSIN MOTOR CORPORATION
Milwaukee, Wisconsin, U. S. A.

World's Largest Builders of Heavy-Duty Air-Cooled Engines

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"MINE KING"

Moulded and Braided AIR HOSE

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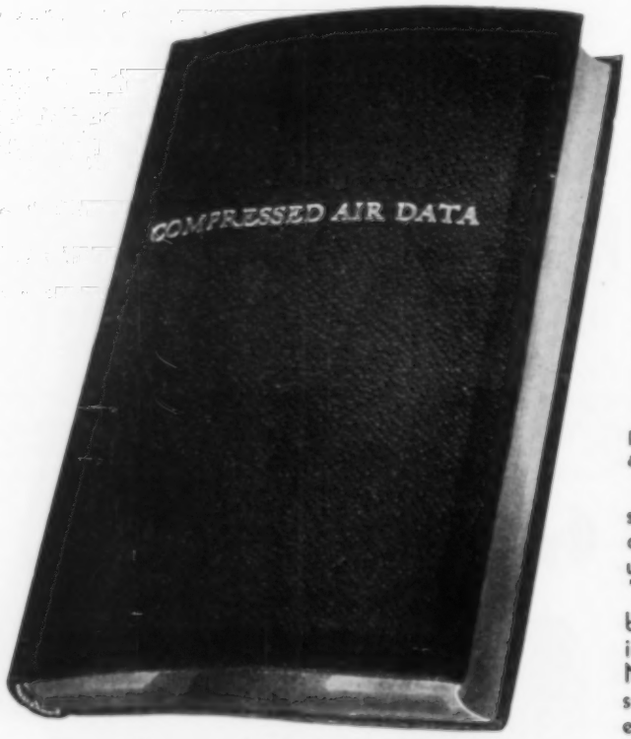

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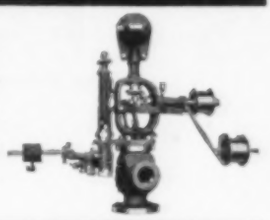
Chapter I....Terminology and Definitions
" II....Theoretical Compression of Air
" III....Boosters and Vacuum Pumps
" IV....Turbo or Centrifugal Blowers and Compressors
" V....Tables and Data
" VI....Intake Air, Aftercooling, Intercooling, Reheating
" VII....Cost of Compressing Air
" VIII....Pumping with Air
" IX....Gas Compression
" X....Installation of Compressors
" XI....Belting
" XII....Application and Performance
" XIII....Measurement of Air Flow

COMPRESSOR EQUIPMENT

SOUNDLY DESIGNED • STURDILY CONSTRUCTED

ERIE GOVERNORS— For steam engines, pumps or compressors. For speed control only or for combined speed and pressure control.



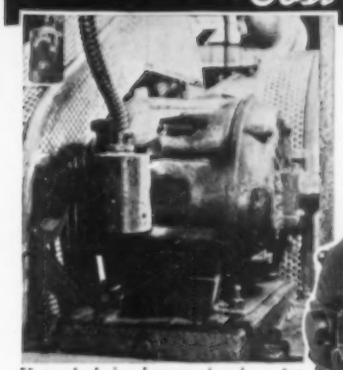
ERIE UNLOADER— Maintains constant pressure by governing inlet of compressor. Loads and unloads without shock or strain.

JARECKI VALVES— Sizes and types to meet every condition, each soundly built, perfectly threaded and individually tested.

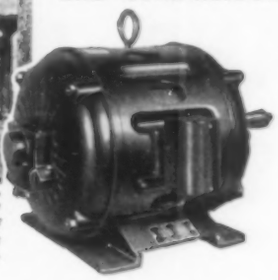
JARECKI FITTINGS— Air-furnace malleable fittings...close-grained, cast iron fittings, all with perfect threads. A complete line.

JARECKI MANUFACTURING COMPANY
ERIE, PA., U.S.A.

Shut-Downs Caused by Motor Failure *Cost You Money!*



use **DEPENDABLE WAGNER MOTORS on your PUMPS and COMPRESSORS**



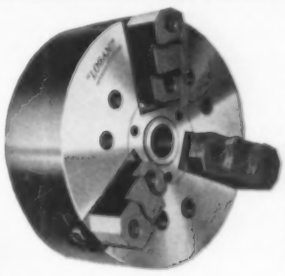
Untouched by human hands... for months on end, and still giving "top" performance. That is the record of thousands of Wagner motors such as the 20-hp type RP driving the air compressor in the above photo.

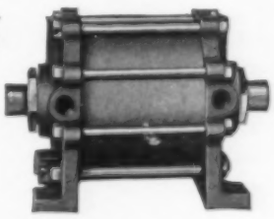
Safeguard your plant against excessive motor maintenance and lost production time by selecting motors that have a reputation for dependability and efficiency. Because Wagner motors are varied mechanically to meet all operating conditions, and varied electrically to meet the requirements of different types of equipment, they are ideal for use in operating all types of pumps and compressors. . . . Whether buying new equipment or replacing motors on equipment you have, it will pay you to specify Wagner. . . . Get the facts—write for bulletins MU-177 and MU-182.

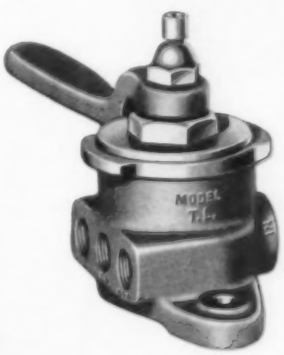
M41-12

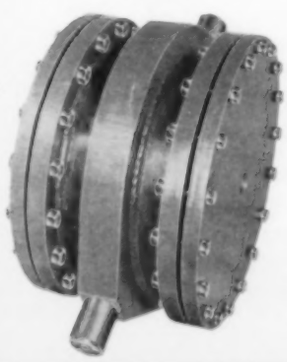
Wagner Electric Corporation
6400 Plymouth Avenue, Saint Louis, Mo., U.S.A.
MOTORS • TRANSFORMERS • FANS • BRAKES

FOR 25 YEARS *"LOGAN"* Air Equipment Has Saved TIME • EFFORT • MOTION









THIS year marks "LOGAN'S" twenty-fifth anniversary. During those years "LOGAN" has solved production problems and speeded up manufacturing in most of the largest industrial plants in the world. And now in these days of great stress "LOGAN'S" entire resources and manpower are being devoted to the defense of America in her Armament Program. Let "LOGAN" Representatives and "LOGAN" Engineers make recommendations on your production problems.

LOGANSPORT MACHINE, INCORPORATED
920 Payson Road — Logansport, Indiana

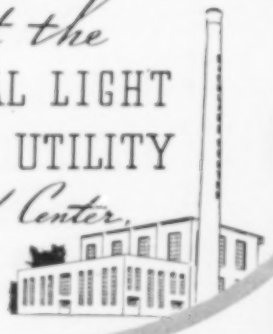
Manufacturers of Air and Hydraulic Devices, Chucks, Cylinders, Valves, Presses and Accessories

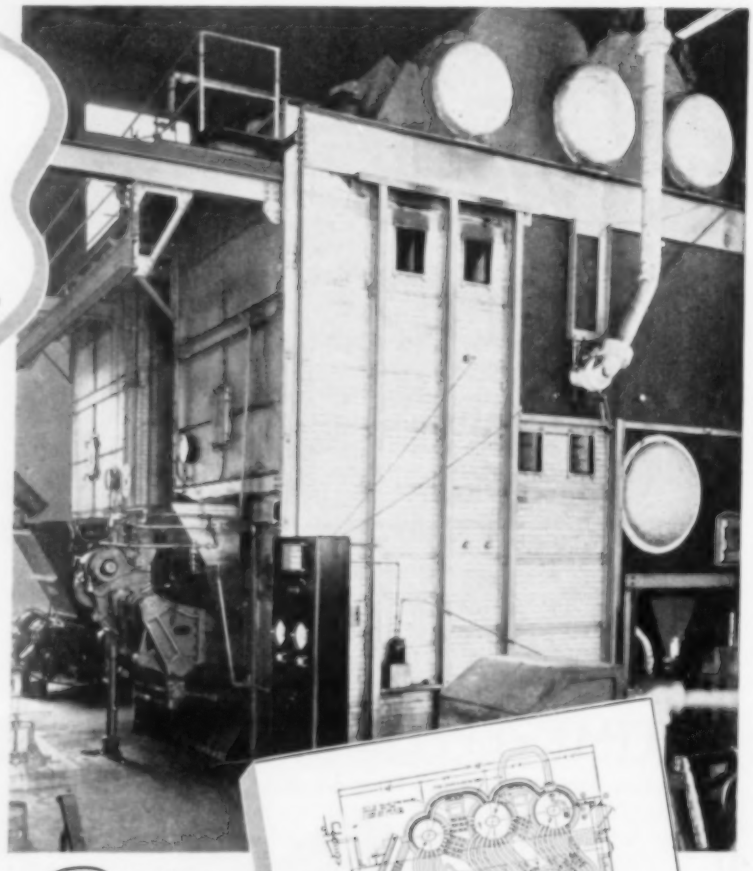
Two Vogt Boilers

BURN 230 TONS *LESS* COAL

AND *INCREASE* POWER 88%

at the
MUNICIPAL LIGHT
AND WATER UTILITY
Richland Center,
Wisconsin





THIS modernly equipped plant, served by two Vogt, four-drum, bent tube boilers, provides dependable, low-cost service the year around for the city of Richland Center, Wisconsin.

A comparison was recently made of the 1939 power output with that of 1935, when boilers of another type, now replaced by the Vogt units, were in service. Plant records revealed that in 1939 a total of 230 tons LESS coal were burned while 2,188,160 MORE K.W. hours were generated than in 1935; a *decrease* in coal consumption and a power *increase* of 88 per cent!

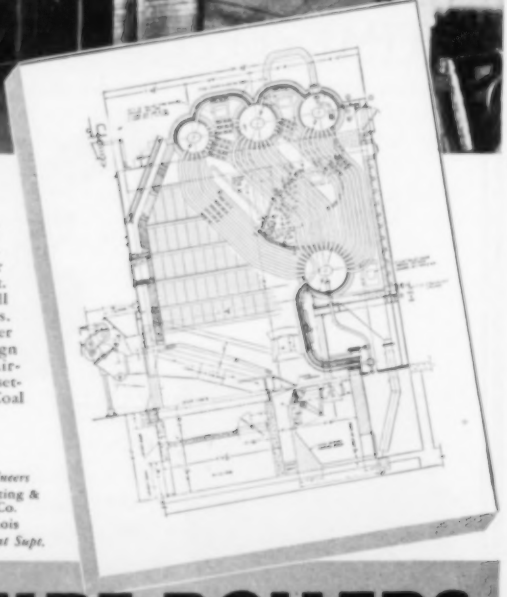
Economize through modernization—Consult Vogt engineers on your steam generating problem!

HENRY VOGT MACHINE CO.
Incorporated
LOUISVILLE, KENTUCKY
New York · Philadelphia · Cleveland
Cincinnati · St. Louis · Chicago · Dallas

Data

Each unit has 4,197 sq. ft. of heating surface and generates 35,300 pounds steam per hour with 115 deg. superheat. * Water cooled bridge wall with Vogt armored tubes. * 225 pounds per square inch design pressure. * Air-cooled boiler setting. * Fuel—Coal screenings.

Consulting Engineers
Commercial Testing & Engineering Co.
Chicago, Illinois
R. H. Strang, *Plant Supt.*



Vogt **WATER TUBE BOILERS**
BENT TUBE, SECTIONAL HEADER & BOXHEADER TYPES

THE MOTOR YOU ASKED FOR IS STRONG ON PROTECTION

New G-E TRI-CLAD MOTOR

1

Extra Protection

AGAINST PHYSICAL DAMAGE

A truly modern motor must withstand accidental blows, flying chips, dripping liquids, and occasional bumps in moving or mounting. We built the Tri-Clad motor to meet such threats of damage!

We made the frame and end shields of cast iron, using channel and rib sections for strength without excessive weight or bulk; we cast the sturdy, rigid feet integrally with the frame. We completely enclosed the upper portion and carefully baffled all ventilating openings to protect vital motor parts. The bearings have dust-tight cast-iron housings. And the finishing touch—we gave the motor a tough coat of paint to protect against rust and corrosion.

The Tri-Clad motor is fully protected against the accidental ill-treatment some motors encounter all the time, and which *all* motors encounter some of the time. As a safeguard against production interruptions, as a prime factor in lowering costs, this new motor means extra profit protection, too.

Make your next induction motors Tri-Clad. General Electric, Schenectady, N.Y.

"BUILT FOR PROTECTION FIRST . . . . . TO LAST"

2

Extra Protection

AGAINST ELECTRICAL BREAKDOWN

New stator windings of Formex wire give extra protection internally against moisture, oil, abrasion, and heat aging. New synthetic impregnating and protecting varnishes make a rigid unit with a hard finish.

3

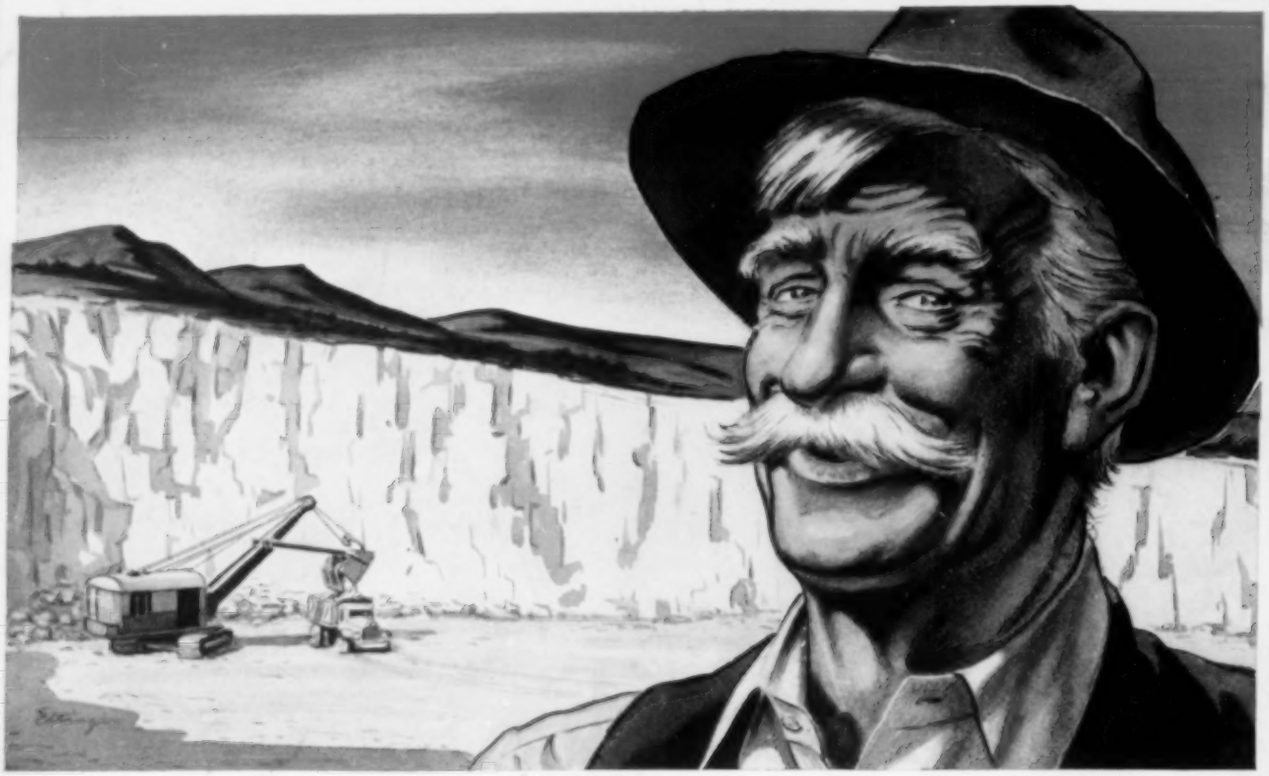
Extra Protection

AGAINST OPERATING WEAR AND TEAR

Sleeve bearings of new design have long life and great load capacity because of new proportions and oil distributing system. The one-piece cast-aluminum rotor winding, with fans cast integrally, is practically indestructible.

GENERAL ELECTRIC

750-49-8058



Joe tells why it costs less to quarry stone today

"QUARRYING SURE HAS IMPROVED. It's a good thing, too, or we'd never get out enough stone for all the new roads and the other construction for national defense.

"They tell me that powder costs alone have been cut 30% right here since the old days, and I can easily believe it. Just

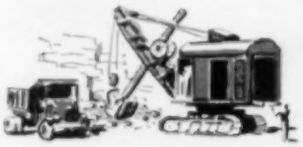
take the saving on secondary shooting. What with these new powders and new ways of shooting, the rock's most all laid down ready for the shovel.

"It wasn't like that when I first came on this job. The stone wasn't broken up so nice, and it was pretty tough on those old shovels trying to load that big stuff.

"It was the Hercules people that started the ball rolling to cut down costs and boost production. They were the first ones to introduce Hercomite*—you know, the powder with lots more sticks in a case. Folks couldn't get the notion at first. But now look at it. Hercomite's used in quarries all over the country and it cuts costs nearly a third in some places.

"Of course, they've been improving Hercomite all the time; and then Hercules brought out that Gelamite* that we could use in wet holes, which saved some more money. You can use wagon drills, well drills, or coyote holes. It doesn't make any difference whether you shoot every day or only once a year, there's a way to do it with one of these Hercomites or Gelamites that will break the stuff just the way you want it.

"Yes, sir, we do a better job around a quarry now, what with the big improvement in the explosives, shovels, drills, and transportation equipment, too; and I figure a lot of the credit belongs to Hercules and the Hercules service men. They got there first with these modern high-count powders, and with all the researching and improving they're doing it looks as if they aim to stay ahead."



HERCULES POWDER COMPANY
INCORPORATED
932 KING STREET, WILMINGTON, DELAWARE

*Reg. U. S. Pat. Off., by Hercules Powder Co.

D-13

HERCULES

EXPLOSIVES AND BLASTING SUPPLIES